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GENERAL

The following Technical Specification shall be read in conjunction with General Technical Specification (GTS) of Bhilai Steel Plant, SAIL and General Specification. If there are any provisions in this Technical Specification, which are at variance with the provisions of General Technical Specification (GTS) of Bhilai Steel Plant, SAIL and General Specification, the provisions in this Technical Specification shall take precedence.

1.0 DOCUMENTS/ INFORMATION TO BE FURNISHED ALONGWITH OFFER.

(i) Clear Scope of supply.

(ii) Exclusions, if any.

(iii) Type and quantity of oil, lubricants & consumables for initial fill till successful commissioning of equipment.

(iv) List of Commissioning spares and start-up spares with unit rates.

(v) List with unit rates of special tools and tackles, if any required.

(vi) Price Schedule for equipment & erection work as per the format enclosed.

(vii) List of recommended spare parts for 3 years trouble free operation and maintenance alongwith unit rates as per the format enclosed in price schedule.

(viii) Technical Data sheets duly filled by the vendor (blank data sheets enclosed).

(ix) Weight of the equipment in Kgs.

(x) Catalogues/ Leaflets and O&M Manuals.

(xi) Copies of G. A. Drawing of the equipment/ System.

(xii) Reference list of your Customers for the similar supply of items.

(xiii) Quality Assurance Plan.

(xiv) Unpriced Copy

(xv) Wagon Tippler - PLC interface details for communication with main plant PLC.

2.0 SCOPE OF SUPPLY

The scope of the supply includes Design, engineering, manufacture, shop fabrication. assembly, testing and inspection at manufacturer's works, packing , dispatch, transportation, delivery to site, receipt, required fabrication at site, completion of facilities, performance guarantee testing, final painting at site and handing over to BSP, SAIL and supervision of installation, testing & commissioning of **WAGON TIPPLER with SIDE ARM CHARGER and ASSOCIATED WORKS** as per specifications and scope defined in tender documents complete with all accessories and electrical, which are not mentioned specifically but are required for the efficient and trouble free operation of the equipment/system.

Following items are also included in vendor's scope.

(i) Complete wagon tippler with side arm charger as per the details given in the specifications except civil works.

(ii) Consumables like first fill of lubricating oils etc. for the initial operation of the equipment till handing over.

(iii) Commissioning spares and start-up spare parts.

(iv) Special tools & tackles, if any required.

(v) Recommended spare parts for (3) three years trouble free operation and maintenance.

(vi) Painting of complete equipment (including final painting before handing over to the Employer).

(vii) Supervision of Installation, testing & commissioning at site.

(viii) All drawings / documents along with operation and maintenance manuals as per requirement mentioned elsewhere in the tender document.

(ix) Getting approval of design/drawings and any other design calculation related to the equipment from BSPI / MECON / EPI.

(x) Power supply at 415V$\pm$10%, 50Hz ±5% and combined voltage & frequency variation ±10% shall be provided at vendor's Main Panel / control desk and equipment JB's only. However supply of MCC and control as required shall be in vendor's scope. .

(xi) Trailing / Flexible Cables as required for the complete system shall be in vendor's scope.

MECHANICAL

3.0 Technical Specifications of WAGON TIPPLER with SIDE ARM CHARGER AND ASSOCIATED WORKS

(A) GENERAL

This specification is intended to broadly cover design, engineering, manufacturer, shop fabrication, supply, transportation, installation, testing and commissioning guarantee performance testing of the complete Wagon Tippler & Side Arm Charger as specified hereinafter complete in all respects and adequate for safe, efficient and trouble free operation of the elevator.

(B) CODES AND STANDARD

The design, manufacture, inspection and testing of Wagon Tippler & Side Arm Charger shall comply with all the currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed. The Wagon Tippler & Side Arm Charger shall conform to the latest edition of standards and codes. Other internationally acceptable standards/ codes, which ensure equal or higher performance than those specified, shall also be accepted. Nothing in this specification shall be construed to relieve the contractor of the required statutory responsibility. In case of any conflict in the standard and this specification, the decision of the Engineer shall be final and binding.

(C) The scope of work of the Bidder includes design, engineering, manufacture, inspection, assembly, shop testing, painting at manufacturer's shop as well as at site after installation, supply at site including dismantling for transportation, packing, loading and transportation, receipt at site, supervision of installation, testing and commissioning of the following items at plant site.

(1) **One no. Side Arm Charger to pull or push a rake of 59 loaded wagons as per IS:10095 1982, Reaffirmed-2001. The Side Arm Charger shall be complete with**

- Trolley with wheels and side guide roller, universal coupling arm along with hydraulic system for luffing.
- Travel drive complete with hydraulic motor, brakes, and hydraulic power pack.
- Rails with foundation bolts & nuts, racks & pinions.
- End stops, Festoon Cable & Trolley with heavy duty carriage and supporting structures.
- Hydraulic Side Arm Charger coupler / decoupler.
- Operator's cabin mounted on trolley of Side Arm Charger.
- Any other item/ accessory/ fixtures to complete supply of the equipment.

(2) **One no. Rota-side Hydraulic Wagon Tippler for guaranteed 20 tips/hr. complete with.**

- Tippler Table with rails, end frame with necessary rack segments, side beam with rubber pads.
- Wagon Tippler hydraulic drive with cylinders, power pack, necessary hoses etc.
- Hydraulic clamping system with cylinders, power pack, necessary hoses etc.
- Vibrator assembly mounted on tippler to enable handling sticky rakes.
- All foundation bolts.
- Control Cabin where from the Wagon tippler and Side Arm Charger can be operated jointly or independently.
- Any other item / accessory / fixtures to complete supply of the equipment.

(3) Emergency stopper for inhaul wagon rake once it is within operating range of the side arm charger.

(4) Dust suppression system. Suitable House/ Canopy for centrifugal fan of Wagon tippler tunnel shall be in bidder's scope

(5) All related electrics and electrical equipment.

(6) Supply of Side Arm Charger and Wagon Tippler shall be complete with its structural, mechanical and electrical components and standard accessories mentioned in the T.S.

(7) 25T wagon axle load and 110T gross weight of wagons (BOX / BOXN / BOXN HA / BOXN HS / BOXN EL / BOYEL / BOBSN / BOBRN) to be considered for design of wagon tippler and track hopper.

(D) Technical Specification/ Design Data

(1) Side Arm Charger

a) Application

The Side Arm Charger (SAC) shall be used for wagon positioning at the wagon tippler for unloading of materials. It shall be used for pushing / pulling a rake of 59 wagons as per IS:10095 1982, Reaffirmed-2001 and locating wagons one by one on tippler.

b) Working

A train of 59 loaded wagons shall be brought in by a locomotive pushing/ pulling and stopped with the leading wagon within range of the Side Arm Charger using track side marker boards (under bidder's scope). The loco will be decoupled and despatched and the charger shall be driven to the leading wagon. It's arm shall be lowered and it shall be coupled to the first wagon of the train. The train shall be hauled forward by the charger until the front of the first wagon is about 4 meters away from the tippler. The charger shall stop and the first wagon shall be uncoupled from the train. The charger shall then inch forward the leading wagon on to the tippler, automatically decouple itself & arm is raised before it travels back to the train. The tippler shall rotate for tippling the wagon. On reaching near the standing train, the charger arm shall be lowered and shall be coupled to the train ready for repeating the cycle. In the next cycle the train shall be drawn up by one wagon length, the front wagon will be decoupled & the next cycle will be repeated. When the next wagon is located on the tippler table the previously tippled wagon shall be ejected simultaneously. On the out haul side the empties form a new train ready for collection by a locomotive.

c) Specification

The supply includes Side Arm Charger with hydraulic power pack, power supply system, supports, electrics, buffer stop, rack & pinion, control cabin, automatic coupler/decoupler etc. The Side Arm Charger shall run on its own track parallel to the main track. It shall have a stroke of suitable length from a point on the inhaul side of tippler to a point on the out haul side.
It shall be fitted with an arm pivoted at right angles and operated through a hydraulic system for raising and lowering. The arm shall have an automatic coupler to couple/decouple the wagons.

The charger frame shall consist of a single fabricated frame on which every other item shall be directly mounted to form a robust compact unit.

The charger shall run on four steel wheels mounted on spherical roller bearings.

To resist the moment reaction of the pushing force, two pairs of steel side guide rollers shall be fitted. They shall be fitted on spherical roller bearings and shall have a simple lockable adjustment for true running and to take up wear. The side guide rollers shall run on the sides of the rail heads of the charger running track.

The arm shall be of welded construction. Raising and lowering of the arm shall be by hydraulic means.

The charger shall have adequate power for pushing a train load of a full rake of 59 wagons as per IS:10095 1982,Reaffirmed-2001. It shall be hydraulically driven through rack and pinion arrangement.

The charger shall be electrically interlocked with tippler for proper sequential

operation with respect to operational & safety requirements.

Easy access, adequate maintenance spaces, working platforms, inspection covers shall be provided for all the equipment located in the Side Arm Charger for safe and quick maintenance. All edges and openings shall be provided with guards. Chequered plates on floor shall be provided to prevent slipping.

Centralised system of lubrication shall be provided for the equipment. However, all parts of the equipment needing manual lubrication shall be easily accessible. All oil pipes and grease nipples shall be well covered to prevent damage from materials from falling on them.

The Side Arm Charger shall be suitable to push or pull 59 loaded wagons as per IS:10095 1982,Reaffirmed-2001 on straight track and shall be suitable to position all types of wagons at the centre of wagon tippler.

The hydraulic system/ components shall be designed / selected so that the working pressure shall not exceed 180 bars.

d) Technical parameters

Quantity	:	One
Type	:	With hydraulic travel drive and hydraulically operated coupling / decoupling arm.
Type of wagon to be handled	:	BOX/BOXN/BOXN HA/BOXN HS / BOXN EL/BOYEL/BOBSN/BOBRN
No. of wagons to be pushed	:	59 wagons fully loaded pulled/ (Gross load 6000t min.)
Gross weight of wagon be considered for purpose.	:	As per IS:10095, 1982, to Reaffirmed-2001 design
Draw bar pull	:	Minimum 37.5t (Pushing/ pulling effort for 59 nos. loaded wagons)
Mode of control	:	From operator's cabin, as well as from Tippler, located on the charger Control Room (either individually or jointly with Wagon Tippler)
Speed	:	0.5 m/sec forward & 0.5 m/sec reverse, (with full rake of loaded wagons) and one slow speed for coupling.

Duty	:	24 hrs/day (continuous)
Power supply	:	Festoon cable system
Travel Drive	:	Hydraulic motor driven through power packs, positive driven through rack and pinion.

(2) **Wagon Tippler**

a) Application

Rota-side Wagon Tippler shall be used for mechanised unloading of broad gauge wagons, as described in IS:10095 1982,Reaffirmed-2001 carrying raw materials such as lump iron ore, iron ore fines, Mn ore, pellet, Quartzite, limestone, etc.

The wagon tippler shall be fed with loaded wagons one by one by a Side Arm Charger. Tippled empty wagons shall be collected on the empty side by ejection through side arm charger while placing loaded wagons on the tippler. The wagon tippler shall unload the materials into receiving hoppers for onward transportation to stock yard.

b) Specification

The Wagon Tippler shall be of robust construction and designed for continuous duty. Wagons shall be clamped automatically by a hydraulic actuated system, and shall be suitable for all types of wagons envisaged in IS:10095 1982, Reaffirmed-2001. The geometry of the clamping system shall be designed to accommodate dimensions of full range of wagons mentioned above.

The tippler shall consist of the following:

- A cradle consisting of a pair of heavy welded steel plate and sector rigidly connected by a large torsion box girder fitted at each end with pivot shafts. The whole cradle shall be carried on these pivot shafts mounted on **heavy duty spherical roller bearing with robust sealing arrangemen**t, in turn mounted on fabricated steel pedestals.

- A rail table carried on a roller in a slotted bearing supported from an extension of the end sectors.

- Four transverse top clamp beams which shall be carried on arms pivoted from the main torsion box girder. These arms shall be connected at their lower end to a ballast box which shall carry pawls for mechanical locking.

- Drive unit with hydraulic power pack etc.

- To cope with occasional jamming of sticky material, the top clamps shall be automatically locked while the wagon is in inverted position, and disengage automatically as the tippler returns the wagons to its normal upright position.

- The drive design shall incorporate controlled hydraulic drive and shall be controlled from remote control post.

- The hydraulic system/ components shall be designed / selected so that the working pressure shall not exceed 180 bars.

- The bearing shall be of antifriction type and equipped with dust seal. Adequate platforms shall be provided around tippler for ease of maintenance.

- The arrangement of the equipment shall offer convenient access for inspection and maintenance of all parts. Access ladders, working platforms, safety hand railings of min 1000 mm height shall be provided wherever required. All edges and openings shall be provided with toe-guards. Safety devices such as limit switches and mechanical stops shall be incorporated so as to ensure rotation of tippler with in limits.

- Centralised grease lubrication system shall be provided for the tippler. However, all parts of the equipment needing manual lubrication shall be easily accessible. All oil pipes and grease nipples shall be well covered to prevent damage from materials from falling on them.

- The tippler shall be interlocked electrically with side arm charger and succeeding equipment (feeders, conveyers etc.) with respect to operational and safety requirements.

c) Technical Parameter

Number	:	01 (for Ore/fines, Limestone, Quartzite, Mn Ore etc.)
Type	:	Hydraulic Rota-side, indoor type
Type of wagon	:	BOX/BOXN/BOXN HA/BOXN HS / BOXN EL/BOYEL/BOBSN/BOBRN
Capacity	:	as per IS:10095-1982, Reaffirmed - 2001
No. of tips/hour	:	20(Rated), 22 (Designed)
Rail gauge	:	1676 mm
Angle of tippling	:	Minimum 165 deg. anti clockwise looking from wagon entry side.
Duty	:	24 hrs/day (continuous)
Type of clamping	:	Hydraulic
Type of drive	:	Hydraulic motor
Vibrators	:	Electro magnetic type 2 nos

4.0 DUST SUPPRESSION SYSTEM

The scope of work of dust suppression system includes:

(a) Plain water dust suppression (DS) system of wagon tippler hopper, track hopper & stock piles.

(b) Plain water dust suppression system for plough feeders of track hoppers. The dust suppression system shall be integral part of the plough feeders and shall be captive unit of these mobile equipment.

Separate set pump (1W+1S) & water tank shall be provided for dust suppression system of each plough feeder.

(c) Dry fog dust suppression system (DFDS) at material transfer points in different junction houses, hoppers/bunker/bin buildings and other dust areas.

(A) Applicable Codes And Standards

The execution of the work covered under this specification shall conform to the latest Indian Standards specification where the same are available or the reputed standards acceptable to the owner / consultant. In case such specifications are not available, the work shall be according to good engineering practice and norms acceptable to owner / consultant.

(B) Design Criteria

(1) Work zone dust concentration shall be less than 5 mg/Nm3 (at 5m to 7 m distance from source) above ambient level .

(2) Water line velocity shall be maintained less than 1.5 m/sec. Water pipe line shall be supported at regular interval. Make-up water, quick fill, drains and overflow connection shall be included at pump station tank. Duplex strainer shall be included at inlet to dust suppression system pumps. IS-1239 heavy class, ERW, G.I pipe line (for size up to 150 NB) shall be used in the water line. The pipes above 150 NB shall be MS, spirally welded, 6 mm thick & conforming to IS:3589. Water pipe line shall be preferably be laid over ground along conveyor gallery. In case of non-availability of same suitable supporting scheme shall be provided to suit site. Underground pipeline (wherever provided) shall have wrapping and coating as per IS – 10221 (preferably wrapping coating shall be coal tar based). Hume pipe protection shall be laid at road crossing area.

(3) IS-1239 heavy class, ERW, G.I pipe line shall be used in the compressed air line. Compressed air pipeline network over ground laying shall be preferred with a minimum slope of 10 mm in 1m (1: 100) along flow and moisture trap with drain provision at regular interval. Compressed air pipeline shall be preferably laid along conveyor gallery or can be supported from building supporting structure. In case of non-availability of same suitable supporting scheme to be developed by the Bidder to suit site.

(4) In wagon tippler , spray nozzles shall be arranged in three rows, at both side of hopper and top of hopper to cover the entire hopper. Water spray in each group of nozzles shall be through solenoid valve. The operation (open/ close) of

solenoid valves shall be linked with the wagon tippler rotation, i.e wagon tippler position switches and timers rotation. There shall be two water pumps (one working and one reserve).

(5) Compressed air station shall be provided for DFDS systems. Standby compressor shall be provided.

(6) At each pump station air receiver capacity shall be considered @ 16% of the compressed air consumption in m3/min or 2 m3 capacity, whichever is higher.

(7) Adjacent to pump station of wagon tippler dust suppression system, MS tank of 5 mm thick with stiffener for 1-hour storage capacity shall be provided by the Bidder. The inside surface of MS tank shall be epoxy painted.

(8) The Bidder shall provide plat form, walkway, stair case adequate for the necessary approach to the equipment for operation & maintenance point of view.

(9) Duplex strainer with SS filter element shall be provided at inlet to dust suppression system pumps to remove all suspended particles exceeding 100 micron

(10) Monorail with chain pulley block shall be provided for handling of equipment of weight more than 300 Kg

(11) The Bidder shall provide the following minimum instruments

(a) High level and low level switch in water tank. Low level switch interlocked with pump operation.

(b) Spring loaded operated pressure release valve (adjustable) at pump discharge line for by passing water line to tank to avoid shut-off condition.

(c) Pressure gauge at all pump discharge line .

(d) Pressure gauge at air-receivers, safety valve and drain provision

(e) At consumer application points following instruments shall be provided :

- Independent pressure gauge & control valve (Ball valves) shall be provided for pressure regulation .This unit shall housed in a steel cabinet of IP-55 construction.
- For flow activation, solenoid operated valves shall be provided in water and airline.
- Belt conveyor load monitoring switch shall be provided for sensing conveyor running with material.
- Pressure switch in compressed air line to prevent spray operation at low pressure.
- Indication lamp in FAS to show ON/OFF operation of spray.
- Individual valve shall have selection mode to run in Auto/Manual mode.
- Sprinkler operation shall be regulating by sequence timer.

(C) Equipment Specification

The equipment for "DFDS" dust control system is grouped into two main categories.

(1) **Main Equipment**

The main equipment shall include spray bar assemblies fitted with dual-fluid air driven acoustic oscillator atomizing nozzles, pressure regulating units, and flow activation stations for ON-OFF control of the system and instrumentation for auto operation.

(2) **Auxiliary Equipment**

The auxiliary equipment shall include water storage and pumping unit with duplex water filter and associate electrical works, air and water piping, enclosures, necessary hoods and skirt boards on belt conveyors / equipment to suit spray nozzle operation. Starter cum control panel shall be provided at pumping station and local control panel shall be provided at different application points.

(D) Brief Specifications of various components of the system are given below

(1) **Spray bar assemblies**

The spray bar assemblies shall be manufactured from stainless steel tubing drilled and tapped for connection of nozzle adapters. A specially designed and selected dual fluid atomizing nozzle shall be fitted into each of the adapters. These nozzles are fitted with acoustic oscillators for atomizing the water into droplets of micronic size by passing them through a field of high frequency sound waves. The nozzles shall be of stainless steel while the adaptors shall be of brass. Each spray bar shall be provided with mounting brackets and flexible hoses for connection to the air & water pipeline.

(2) **Pressure regulating units (PRU)**

The performance of "Dry Fog" type dust control system is critically related to the size of water droplets. The nature and particle size of dust generated in the material handling system changes with change in size and characteristic of the material. In practice, the sizes of the dust particles have a very wide spectrum (1-800 microns).

A careful control of air and water flow & pressure is therefore necessary to obtain optimum dust suppression results. For this purpose, pressure regulating units shall be provided in the system. The pressure regulating unit shall consist of diaphragm type pressure regulator with pressure gauge and ball valve for isolation of air and water line. The operator can adjust both the air and water pressures independently to change the fog characteristics to obtain optimum dust suppression results vis-a-vis the site requirements. The pressure regulators shall be installed in a metallic enclosure with inspection door with rubber sealing arrangement. Flexible hose shall be provided for connection of PRU to the air & water pipeline.

The number of pressure regulating units shall depend upon the position / elevation of spray bars. Generally independent pressure regulating units shall be provided when the elevation of spray bars exceeds 3 m. Further the number of nozzles operating from one PRU should not exceed 6 ~ 8.

(3) **Flow activation stations (FAS)**

The flow activation station shall consist of solenoid valves in air & water line, pressure switch in the airline, selector switch, and indication lamps. Isolation ball valves shall be provided in the air & water line. All the equipment shall be installed in a metallic enclosure with inspection door with rubber sealing arrangement. Flexible hoses shall be provided with each FAS for connection to air and water pipeline.

The "ON - OFF" control of the fogging system shall be through the flow activation stations with facility for both manual and auto mode. A three position selector switch shall be provided to select the mode of operation. The switch when energized shall open the electric solenoid valves, which shall permit compressed air and water to enter into the pressure regulating units and spray bars.

In addition, a pressure switch shall be installed in the airline to ensure that air and water solenoid valves are energized only when sufficient air pressure is available in the line. This shall ensure that the system cannot operate without sufficient air pressure to the nozzles and reduces the chance of un-atomized water to pour into the dust source. Flow activation shall have indication for: -

- System ON
- System OFF due to lower air pressure

(4) **Auto operation**

The flow activation stations shall have provision for both manual and automatic operation. For manual operation, the system shall become operational with selector switch in manual mode and in auto mode, the fogging operation starts on receiving a signal either from a speed switch cum belt load monitor or limit switches installed at a strategic location in the material conveying line or potential free Tender from the drive motor of equipment as per requirements.

Each dust suppression system location shall be provided with requisite number of spray bar assemblies with DFDS atomizing nozzles. Pressure regulating units shall be provided at each location to regulate the pressure of compressed air and water.
The dust suppression system shall be divided into independent circuits taking into account the flow diagram, operational requirements, distances between dust suppression locations etc. Flow activation stations with instruments for auto operation are provided for each circuit for ON/OFF control of the dust suppression system.

(5) **Centrifugal Pump :**

Horizontal back pull out pump shall be provided. Pump casing shall be vertically split type. Impeller rpm shall generally not exceed 1450. However, for pumps with low capacity & high head may be provided with 2900 rpm. Pump shall be

coupled to motor with flexible coupling. Spacer type coupling shall be provided. Pump shall conform to IS: 1520.

Pump shall give satisfactory performance at any point on the H-Q curve over a range of 40% of rated flow to 120% of the rated flow. The maximum efficiency shall preferably be within ± 10% of the rated design flow. The total head - capacity curve shall be continuous rising towards the shut off without any zone of instability and with a minimum shut-off head of 15% more than the design head.

Pumps shall have shaft seal by gland packing. Pump shall be fitted with double wearing rings , one is fitted in the front of the impeller on the casing and the other is fitted in the back of the impeller on the impeller itself.

Impeller shall be dynamically balanced. The magnitude of peak to peak vibration shall be limited to 75 micron. Pump impeller shall be non overloading type. Impeller shall be made in one piece & keyed to the shaft.

- Material of construction
  - Casing - C.I
  - Impeller - Bronze
  - Bearing Bracket - C.I
  - Shaft protection sleeve - Bronze
  - Wearing ring - Bronze
  - Shaft - EN-8
  - Common base frame for pump & motor - M.S

Common base plate for pump & motor shall be in one piece & made of welded steel construction. Adequate space shall be provided between pump drain connection and base plate for installation of minimum 15 mm drain piping. Pumps shall be supplied with suitable drain pans or drain rim type base plates with tapped drain connections.

Critical speed of the shaft shall be at least 30 percent above the operating speed.

(6) **Water Piping and Fittings**

Water piping up to 150 mm NB size shall be GI, ERW, heavy class and conforming to IS-1239 Part- 1 . The pipes above 150 NB shall be MS, spirally welded , 6 mm thick and conforming to IS:3589. Pipe ends shall be beveled. Pipe fittings shall be as per IS 1239, Part -2 for pipes of size up to 150 NB. Fabricated fittings manufactured from the pipes may be provided for pipes of sizes 200 NB & above.

Plate type pipe flanges (as per IS 6392) shall be provided.

Pipes shall be of welded joints. Welding (manual metal arc welding) shall be as per relevant IS code and only certified welders shall be employed.

All piping systems shall be hydro tested at 1.5 times the design pressure.

Auto air venting valves shall be provided at highest point of the pipe lines & drain valves shall be provided at lowest points of the pipelines in different segments.

Pipe supports comprising pipe shoes, saddles, base plate, clamps & structural members like channels, angles etc. shall be provided

(7) **Valves**

Butterfly Valves shall be provided in water line of size 65 NB and above and ball valve shall be provided for pipe size below 65 NB. However, ball valve shall be provided in the pipe line (irrespective of sizes) when flow control is required.

(a) **Butterfly valve**

Type	:	Wafer design, flange less
Body	:	SG iron with nitrile rubber/ EPDM lining
Disc	:	SG Iron with teflon (PTFE) coating
Stem	:	High tensile stainless steel

The valves shall be provided with integrally moulded & bonded body liner to provide perfect seating and complete isolation of body material from fluid. The body liner shall provide the seating to valve disc, primary seal to the stem & gasket joint with mating pipe flanges. Valves shall be provided with self locking lever operation from open to fully closed position with intermediate positions marked on the indicator plate mounted on the top flange. The valves shall conform to BS : 5155 / IS : 13095. Extended valve shaft shall be provided so that the lever can be operated without any obstruction on the insulated pipes. Gear operated valves shall be provided for sizes more than 250 NB.

(b) **Ball Valve**

Body	:	Cast steel
Body liner	:	Nitrile rubber/ EPDM
Ball	:	ASTM A351 Gr CF8

3 piece design
Socket welded type

Ball valves shall be with 200 mm length welded joint pipes from manufacturer works.

(c) **Check valve**

Type	:	Dual plate check valve with two springs hinged on a central hinge rod
Body	:	SG iron
Body liner	:	Nitrile rubber/ EPDM
Disc	:	ASTM A351 Gr CF8

Wafer design

(8) **Air Receiver (1 no for each pump station)**

Vertical self supporting in cylindrical design with dished end at both ends having minimum capacity of 2 m3 volume. The air receiver shall be designed for a working pressure of 8 kg/cm2 g. Design, manufacture, inspection and testing of air receiver shall be in accordance with IS:7938 and IS : 2825 -1969

(RA 1984), Class-2, Dished ends IS:4049 Part-I, 1979 (RA 1991). Material of construction shall be as follows:

Shell and dished ends	:	IS: 2002 Gr2 or equivalent
Supports pad, leg, skirt, base	:	IS: 2062-1992
Plate, nozzles	:	A 105 (below 300 mm NB) A 106 Gr B (above 300mm NB)
Flanges & matching flanges	:	A 105

The air receiver shall be supplied with following accessories:

- Circular skirt welded to the bottom portion of the shell.
- Circular base plate welded to the skirt with holes for foundation bolts.
- Foundation bolts/ studs, nuts, washers.
- Nozzles for inlet and outlet with weld neck flanges.
- Manhole nozzle at an accessible height with weld neck flange and cover having devit arrangement.
- Safety valve of sufficient blowing capacity mounted at a suitable height connected through a flanged joint to nozzle welded on the receiver shell. Safety valve shall be provided with test lever and gagging arrangement.
- Vent valve at the highest point of the dished end for releasing the air during hydro test.
- Water drain nozzle at the lowest point with drain isolation valve, trap station and by pass valve.
- Companion flanges with bolts, nuts and gaskets for inlet and outlet nozzles and other valves.
- Stubs for pressure indicator for local measurement of pressure.

(9) **Pressure Gauge**

Manufacturing Standard	:	IS 3624
Range	:	0 – 6 Kg/ cm2 or 0-10 Kg/ cm2
Range (at pump suction)	:	(-)2 to (+) 2 Kg/ cm2
Dial Diameter	:	100 mm
Accuracy	:	+ 1% of FSD
Degree of protection	:	IP 65
Sensing element	:	Bourdon tube
Bourdon tube material	:	AISI SS316
Connection	:	Screwed
Connection size	:	½ " BSP (M)
Mounting	:	Direct with bottom entry
Case	:	Die cast Al stove enamelled black finish
Bezel (screwed)	:	Die cast Al stove enamelled black finish
Dial window	:	Shatter proof glass
Pointer	:	Al anodised black
Dial	:	Al white with black letters
Movement assembly	:	AISI 304SS
Shank	:	AISI 3166SS
Adjustable pulsation damper	:	Yes

Pressure gauges shall be provided with isolation valves (Ball valves)

5.0 HYDRAULICS

(A) Facilities to be provided in the Hydraulic Power Pack Room.

Hydraulic power pack shall be installed in room where adequate provisions are made to keep ambient air free from dust, moisture and ambient temperature shall be kept below 35^0C.

Adequate facility shall be provided for handing of equipments/ components installed in the power pack room.

Adequate illumination.

Adequate fire alarms, fire protection system and fire fighting facilities.

Antiskid title floor shall be provided in the power pack room.

Design of floor shall be such that spilled oil / leakage oil, if any is collected into drain pit and from there, arrangement shall be provided for collection and disposal of leakage oil into oil barrels for reclamation purpose.

Emergency doors and Adequate space to carry out maintenance activities.

Hydraulic circuit of the system on anodized plate(s) shall be provided.

(B) Whatever Servo / Proportional Valves are used in the system, supplier shall supply Servo Valve flushing facility and test kits for Servo and Proportional Valves.

(C) For hydraulic systems with conventional valves, the supply voltage to various controls shall be 24 DC.

(D) BSP's approved preferred make in vogue shall be followed.

(E) Mineral oil shall be used in hydraulic systems until otherwise agreed upon by BSP.

(F) All the pipes and fittings used in hydraulic systems of critical production units shall be stainless steel until otherwise agreed up on by BSP.

(G) Filters shall be provided for continuous removal of contaminants from the hydraulic fluid, which are likely to cause malfunction of pumps, valves and actuators and maintain desired cleanliness level of hydraulic fluid. Adequate filtration shall be provided for each system considering the ingress rate of contaminants in each applications.

(H) All the pressure line, return line and circulation filters shall be of absolute filtration design with B (x) ratio greater than or equal to 200. Total delta p across filters shall not exceed 0.5 bar with filter element in clean condition. (Total p means pressure drop across clean filter element plus pressure drop filter housing).

The micron rating shall be as specified in T.S. for individual filters.

(I) All the hydraulic system shall be provided with dedicated oil purifier. The oil purifier (vacuum dehydrator type) shall be capable to remove undissolved as well as dissolved water and solid containments from the hydraulic oil of the system in a reasonable time to the desired level.

(J) Portable oil transfer unit with built in filtration facility shall be provided for transfer ol from barrels to oil reservoir of the system.

(K) Calibration and Testing Facilities for the Hydraulic Components installed in the hydraulic systems shall be provided as detailed below.

The scope of work covers design, engineering, manufacture, supply, erection, testing and commissioning of following facilities :-

1. Power pack for Test Rigs of conventional control values, pumps, motors and hydraulic cylinders.
2. Test rig for conventional control valves.
3. Test rig for pumps and motors.
4. Test rig for hydraulic cylinders.
5. Test rig and Power pack for Servo and Proportional valves (if Servo / Proportional valves are used / installed in the hydraulic systems).
6. Repair benches for the above components.
7. Cleaning Station for hydraulic components.
8. All connected electrical, instrumentation and automation equipment and accessories.

The scope of supply shall also include all components and accessories as required to tender the system complete in all respect.
All the above equipments / components handling facility shall be provided. Adequate facility shall also be provided for storage of components (both un - repaired and repaired / tested components.

The Test Rigs shall have facilities for on-line acquisition of test parameters of the components while testing and shall be transferred to the main computer for records and references.

(L) Plate Type Heat Exchanges of adequate capacity shall be provided in the Hydraulic Systems.

(M) The hydraulic system shall have facility for on-line Pressure measurement in P, T, A and B lines at suitable locations of the circuit. Necessary instruments, conditions monitoring system and facilities shall be provided by the supplier.

(N) Necessary training shall be imparted by the supplier to Engineers Technicians with regard to operation and maintenance of the systems.

(O) HYDRAULIC PIPE LINE ERECTION, TESTING, PICKLING, FLUSHING AND COMMISSIONING

Hydraulic pipe work shall be assembled, pressure tested, pickled, flushed and commissioned as per piping instructions given by the system designer / consultant.

Provision of pipe line pickling and flushing facility shall be in the scope of work (provision of separate tank, pumps filters elements, pickling and flushing fluids shall be the supplier's scope).

Supply of minimum 50 nos. of spare filter elements of each type along with the hydraulic system at the time of Erection, Testing and Commissioning shall be in the supplier's scope of supply.

Oil cleanliness shall be checked during commissioning and facilities for checking and monitoring oil cleanliness shall be in the bidders scope of supply.

Suppliers Scope of Work in hydraulic pipe work shall also include :-

1) Equipment Supplier shall give a comprehensive cleaning and flushing scheme for hydraulic systems and provide necessary facilities to carry out the activity.

2) Adopt cleaning and flushing guidelines from ISO 5910.

3) Hydraulic System cleaning and flushing documents shall be part of acceptance checks in the Quality Assurance Program. Compliance to this shall be reported in the overall QAP.

4) Develop a plan for how to systematically control hook-up of subsystems into the main system. Documentation of results as part of the total flushing procedure. Describe cleaning and flushing connections and looping methods along with the details of components required to carry out the above.

5) Suppliers to specify sampling points to be used for condition monitoring during flushing and in service.

6) Connection program after cleaning and flushing is over with built-in check for prevention of contaminants during connections and assembling.

7) Acceptance norms shall be given by the Equipment Designer / Supplier.

(P) All pipelines shall be of seamless type clamped with polypropylene heavy series clamps. However, in the hot zone heavy series aluminum clamps shall be used.

(Q) All hydraulic pipe lines shall be painted as per the standard color mode.

(R) Special Conditions for hydraulics:

1) Off line filtration shall be provided and Differential pressure shall not be less than 0.3.

2) Pumps speed shall be 1500 rpm. Electrical motor pump shall have 25% reserve power over and above required for operating the pump at working pressure and flow.
3) The number of standby pumps shall be as follows:

Up to 3 nos. working pumps : 1 no. standby

For 4 to 6 nos. working pumps : 2 nos. standby

4) The following cleanliness level of oil shall be maintained for hydraulic systems:-

Systems without servo valves/ proportional valves: NAS.7.
Systems with proportional valves: NAS.5.
Systems with servo valves: NAS.4.

5) All filters shall have ß ratio ≥ 200. the fineness of various filters shall be as follows:

Hydraulic systems without proportional and servo valves	Pressure line filters	: 10micron
	Circulation filters	: 10 micron
	Return line filters	: 10 micron

6) The capacity of pressure line, circulation filters, return line filters shall be as follows:-

a.	Return line filters	:	3 times of maximum return flow or 3 times of maximum pump flow whichever is greater at Δ p= 0.5 bar (total) in clean condition.
b.	Circulation filters	:	pump flow at Δ p= 0.5 bar in clean condition.
c.	Pressure line filters	:	2 to 2.5 times pump flow at Δ p= 0.8 bar in clean condition.

All the filters shall be of absolute filtration design.

7) Solenoid coil voltage shall be 24 VDC
8) First fill of oil shall be in the bidder scope of supply.

The specification of hydraulics as indicated above shall be applicable for hydraulic drives of wagon tippler, side arm charger, stacker and bucket wheel reclaimer.

ELECTRICAL & INSTRUMENTATION

6.0 ELECTRICAL POWER DISTRIBUTION, DRIVES, CONTROL & ILLUMINATION FOR WAGON TIPPLER & SIDE ARM CHARGER

(A) General

This section covers major features of Power Distribution System, Shop-Electrics, Drives, Control, Automation and Illumination System to be supplied by bidder for the Ore Handling Plant Part-B Complex.

The Bidder shall refer to General Technical Specification (GTS) for Electrics and Illumination for detailed specification of equipment / components. This Technical Specification (TS), General technical Specification (GTS) including Preferred Makes for Equipment and other attached documents considered, as a whole shall comprise the complete Tender Specification. These are complementary and anything laid down in one and not in other will be deemed as binding, as though laid down in the Tender specification as a whole. In case of conflict between the Technical specification and GTS, the Technical specification (TS) shall prevail.

(1) Complete electrics for Wagon tippler and Side Arm charger (SAC).

- Motors with necessary accessories and brakes.
- Conventional type Control panel, VVVF drive panels, PLC panel at Electrical room and Control panel on SAC.
- Control desk both at control room and on SAC. Provision in control desk for control of Dust Suppression system for Wagon Tippler.
- Weighing facility with load cells for recording and transmitting data of incoming materials to Despatchers D1 & D2 and central control room.
- Local Control Station and Field devices such as actuators, valves, photo-electric sensor/relay, limit switches, proximity switches, encoders, position transducer, isolators, safety switches, speed sensors, junction boxes; warning hooters, Rail Clamp, Earth shoes etc.
- Plastic Power cable carrier system and necessary Flexible cables.
- Air Conditioning / Ventilation facility for Electrical panel room and Control room.
- All power, control and special / instrument cables, cabling, terminations etc.
- Complete earthing of machine including rail earthing.

(B) TECHNICAL SPECIFICATION FOR WAGON TIPPLER & SIDE ARM CHARGER (ELECTRICS & AUTOMATION)

(1) **General**

GTS shall be referred for technical specification of various electrical equipment. However for specific application following TS shall be considered.

(2) **Wagon Tippler and Side Arm Charger**

(i) **Variable Voltage Variable Frequency Converters (AC Drives):**

- AC drives shall have communication facility with PLCs for data transfer and speed reference set point.

- Software of AC drives shall be developed in such a way that after over voltage or under voltage when the drive trips, the AC drive shall be automatically resetted without any manual intervention after normalising of the voltage.

- Remaining features shall conform to General Technical Specification

(ii) **Programmable Logic Controller (PLC) :**

- The system shall be complete with CPU, I/O racks, memory, key board and monitor. HMI shall depict graphics of various mechanism operations and also provide alarm annunciation system. Spare CPU with loaded software shall be installed in the PLC panel.

- Communication between PLC and AC drive shall be possible for smooth operation of the Tippler. PLC shall have facility to communicate with Despatcher-D1 / Central Control room PLC. All the required hardware and software for these communications shall be provided.

- PLC shall perform the following task :
  (i) Logic interlock functions, control & supervision of drives & solenoid valves.
  (ii) Automatic sequential operation of various drives.
  (iii) Status indication & signaling.
  (iv) Fault monitoring & annunciation.
  (v) Diagnostic features to recognise and display faults.
  (vi) Communicate with Despatcher-D1 / Central Control room PLC. PLC input interrogation voltage shall be 230vAC and output voltage 24vDC

- Remaining features shall conform to General Technical Specification.

(iii) **Control Desk :**

- Control desk shall be provided for centralised control, monitoring of all the drives of Wagon tippler and SAC, including annunciations of all the faults, over-load trip condition of drives, failure of safety devices, all faulty conditions, warning conditions, over/under positioning conditions, over travel conditions etc. Separate and independent annunciation for each shall be provided instead of group annunciation.

- Control desk shall have suitable nos. of status indication lamps to cover complete dust suppression system, SAC positions & movements

including arm positions etc. and also for down stream equipment of wagon tippler.
- A control desk shall be provided also on the side Arm Charger.
- Remaining features shall conform to General Technical Specification.

(iv) **Weighing System :**

Microprocessor based weighing system shall be provided. The load cell shall be magneto – elastic type / strain gauge type, suitable for over load up to 300% of their nominal load. Minimum 3 (three) numbers of load cells are to be provided at each weigh bridge integral with wagon tippler table. Accuracy of weighing system shall be +/- 0.1% or better. For other features Specification for Belt scale shall be referred.

Indicating cum data logging type weighbridge for weighing both loaded and empty wagon shall be complete with PC based operating station in the wagon Tippler Control Room.

The supply shall be complete with the following :
Load cells, signal converters, PCs , 19" colour monitor, keyboard, mouse, etc.), original licensed operating software and application software, inkjet printer, UPS, control room furniture for installation of PCs, printers, power distribution boards, etc.

The capacity of the weigh bridge shall be adequate to permit passing of 180 metric tones weight of shunting loco at the speed of 8 Km per hour.

Remaining features shall conform to General Technical Specification.

(v) **Control and Operational Requirement**

All drives and mechanisms shall have Auto, Remote – interlocked mode and Local mode controls. Local controls shall be provided and normally it will be used for maintenance and testing purpose only. Only safety interlocks shall be covered in Local control. STOP push button of Local control shall be able to stop the drive/mechanism selected for any mode of control.

It shall be possible to operate the side arm charger (SAC) both from control panel located in the Operator cabin of SAC and Control desk located in the control room. Auto operation of SAC along with wagon tippler operation shall be done from Control desk. SAC operation from its control box in the SAC operator cabin will be done as required after the receipt of instructions / permissive from control desk operator.

Operation philosophy shall be developed in such a way that normally one operator shall be required to operate the wagon tippler and SAC from wagon tippler control room and one helper near tippler table to de-couple the leading wagon from the rake. Emergency stop switch shall be considered at WT and SAC in addition to control desk.

The loaded wagon to be tippled will be decoupled manually from the rest of the rake and the person doing the decoupling operation will press a switch installed near-by to indicate to control room that decoupling operation is complete. Subsequently, pulling of the wagon by SAC, placing it on wagon tippler, return of SAC to wagon rake for start of next cycle, tippling of wagon by wagon tippler etc. shall start automatically in proper sequence.

The SAC will pull and place the decoupled wagon over the tippler. Once the wagon is placed on tippler deck and SAC clears the tippler deck, tippler will clamp the wagon, tipple it, return to its original position, declamp the wagon and other operations as required. The wagon vibrator will operate automatically, if selected for auto-mode when the wagon is in inverted position. The type of wagon being unloaded, identification of sick wagons etc. will be registered in Control desk by the control room operator.

The water spraying for dust suppression will start automatically when wagon is being tippled and will stop when the tippler is not operating by establishing suitable interlocking between controls of wagon tippler and dedusting system.

Each operational cycle will be repeated automatically till the last wagon is tippled and removed from the tippler deck. The complete operation will be done in automatic sequentially interlocked manner and some of the activities will be parallel so that system can easily achieve a required tippling rate per hour.
Positioning of Wagon Tippler and SAC will be through proximity switches and backed-up by heavy duty rotary limit switches. All limit switches and proximity switches must work smoothly and without adjustment and mal-functions under severe conditions of vibrations. All rotary switch and limit switches should be mounted and housed with suitable vibration damping arrangement.

Wagon counter shall be provided with correction facility by authorized person to account for sick wagons.

Laser Beam sensors with transmitter and receiver at both ends of Wagon Tippler to ensure that no other wagon is in close proximity to the wagon tippler table.

(vi) **Drawings & Documents**

Bidder's scope of work for all design drawings and documents shall be as given below.

The bidder shall submit a list of all drawings and documents he proposes to submit within 2 weeks of LOI. The list will be approved by Client / MECON and may be modified if necessary. Each drawing/documents in the list shall be identified with a serial number, description and scheduled date of submission.

Bidder shall also furnish soft copies of all the drawings indicated below and drawings of technological layout/units.

All design, engineering and manufacturing drawings shall be required to be approved by Purchaser/Consultant.

Work shall be carried out exactly as indicated on the approved drawings and specification. No alterations shall be made without prior written approval by purchaser / his consultant.

The bidder shall check all the drawings prepared by them and/or received from their vendors/supplier/sub-supplier and satisfy themselves about the correctness of drawings before issuing to Purchaser/Consultant. After checking, properly stamped drawings shall be sent to Purchaser/Consultant for approval / clearance.

Comments on all drawings will be forwarded to the successful bidder for incorporation and resubmission.

The approval of drawings by purchaser or their authorized representative does not absolve or relieve the supplier from any of his obligations under this contract and he shall be wholly and solely responsible for the satisfactory operation and guaranteed performance of equipment / system / plant.

(a) **Information / data / drawings to be furnished by the Bidder along with the Tender. (Electrical)**

1. List of equipments considered for supply (Unpriced copy).
2. General description of equipment offered specifying the important features, make, technical parameters, materials of construction, etc. to enable the owner to have proper understanding of the equipment offered and its operation. Technical details shall be supported by manufacturer's.
3. Literature/ catalogues of offered equipment.
4. List of Basic Engineering drawings.
5. Drive list indicating kW ratings.
6. HT and LT Motor data sheet as per enclosed format.
7. Feeder requirements from purchaser at 6.6 kV indicating maximum demand of each feeder, overall maximum demand of each LT substation and total connected load and maximum demand of the plant.
8. Power supply distribution scheme indicating numbers of HT/LT substations, transformers, HT motors etc. and CL/MD.
9. Proposed location of electrical premises such as LT substations, electrical rooms, control room, cable tunnels/Overhead Cable Structures/Bridge etc.
10. Single line diagrams for Power Control Centres, Motor Control Centres/ Control Panels, Power Distribution Boards, Main Lighting Distribution Boards, Lighting distribution boards etc.
11. Typical control scheme of a DOL/RDOL feeder indicating inputs & outputs considered.
12. Basic power and regulation diagram of VVVF converters for AC drives.

13. Tentative Equipment layout in electrical premises with tentative dimensions of all panels.
14. List and capacity of emergency loads and their feeding arrangement.
15. Automation system configuration with list and details of hardware. Details about numbers & locations of RI/O panels & count of Inputs & outputs of various types considered. I/O count of each type should distinctly specify the I/O count + spare I/O count + chassis capacity of additional I/O.
16. Details & Scheme of Illumination system and Emergency lighting.
17. Details & BOM of Electrics related to Yard Machines, Wagon Tippler & Side Arm Charger, Ventilation and Air conditioning system etc.
18. List of commissioning spares.
19. List of spares for 2 years normal operation.
20. List of insurance spares.
21. List of special tools, tackles, instruments and calibration equipment & devices.
22. List of deviations, if any, from Technical Specification & G.T.S.
23. List of exclusions.
24. Duly filled in questionnaire.
25. Reference list of similar jobs.
26. Time bar chart indicating various activities starting from date of placement of order till commissioning.
27. Any other details which may be felt necessary.

(b) **Basic Engineering drawings (Electrical)**

1. List of drawings (Basic Engg /Detailed Engg/ Reference) and drawing numbering system along with schedule of submission.
2. Single line diagrams of MCCs /Control Panels, PDBs, MLDBs, LDBs, SLDBs, Main fire detection and alarm panel etc. with rating of components, cable sizes and details of protection and metering etc.
3. HT & LT Motor and component list including field mounted electrics
4. HT and LT Motor data sheets as per enclosed format.
5. Type-II Co-ordination chart as per IS: 13947-1993 for MPCB/ MCCB, Contactor and Overload relay.
6. Schematic drawing of different feeders, control, alarm, indications, interlocking and other schematics.
7. Shop/Unit wise Maximum Demand calculations.
8. Relay settings with calculations for total network to ensure proper co-ordination.
9. Busbars sizing calculation with respect to temperature rise & short circuit withstand capacity.
10. Design Calculations for selection of main equipment such as transformers drive motors, AC drives, bus bars, cables, batteries etc.
11. Typical schemes of DOL, RDOL feeders indicating inputs & outputs applicable to the various feeders indicated in SLDs.
12. Power and regulation schemes of AC drives.
13. Calculation for temperature rise of busbars.
14. Layout of substations, electrical rooms and control rooms including ventilation and air-conditioning rooms, handling facilities. The layout drawings indicating cable trench, wall openings, conduit inserts, plate inserts, Minimum clearances from electrical panels for installation of panels, cable trays, conduits for concealed wiring etc.

15. Electrical Equipment Layout of all electrical rooms, control rooms indicating panel dimensions, space available for future expansion with building dimensions.
16. General arrangement of equipment with plan, front view and sectional views, comprehensive bill of materials with description, quantity, make and type.
17. Cable layout drawings in cable tunnel, cable channels, overhead cable structures/bridge and incoming cable route etc.
18. Interplant cable route drawings.
19. Type tests certificates of all major equipment like transformers, switchgear etc.
20. Level-1 automation system configuration & I/O lists, Belt Scale, Belt Weigh feeder, UPS & VVVF single line diagrams.
21. Functional description, control philosophy for the plant indicating start up, shut down, control locations, interlocking and annunciation system, mimic pages, report/data formats (for reference).
22. Sizes, ratings & locations of various LDBs & SLDBs.
23. Tentative Dimensions of panels.
24. Earthing and lightning protection scheme and layout of earthing and lightning protection network with calculations.
25. Quality assurance plan for various electrical equipment.

(c) **Detailed engineering drawings (Electrical)**

1. Civil/Structural engineering design drawings of Electrical buildings, Electrical rooms, Control rooms, Motor foundations, Cable tunnels, Overhead cable structures/Bridge etc.
2. General arrangement of all electrical equipment/electronic panels/controllers with plan, front view and sectional views, comprehensive bill of material with description, quantity, make and type.
3. Equipment and cable layout drawings in LT Substation, Electrical premises, Control rooms etc.
4. Schematic drawing of different feeders, control, alarm, indications, interlocking, inputs/outputs to PLC and other schematics.
5. Single line diagrams of all PCCs, MCCs/ Control Panels, PDBs, MLDBs, LDBs, SLDBs, UPS, other equipment Control panel for sump pump, magnet and other auxiliary system etc. Module wiring diagrams indicating all interlocks, terminal numbers. Wiring terminal plan drawings with cable connections.
6. Single line diagram of VVVF Drives, Soft Starter etc.
7. GA, BOQ, Layout drawings, dimensional details for LT switchgear equipment, MCCs/Control Panel, PDBs, MLDB, LDBs, SLDBs, Main fire detection and alarm panel etc. with rating of components, cable sizes and details of protection and metering etc.
8. Level-1 automation system software and graphic displays.
9. I/O listing in specified format to be finalised during engineering.
10. Sizing calculation of the UPS and the backup battery. UPS panel wiring diagram and circuit diagrams.
11. Wiring terminal plan drawings with cable connections.
12. Technical data sheets for Motor, Brake, Proximity switches & all field mounted electrics, GA drawings.

13. Interplant cable route drawings.
14. Layout of cable trays in cable cellars inside the substation & other electrical premises, cable channels, cable tunnel, overhead cable structures, cable shafts etc.
15. Cable layout drawings in cable tunnel, cable channels, overhead cable structure (as applicable), and incoming cable route etc.
16. Power & control cable schedules
17. GA drawing for erection accessories like cable trays, supporting structures etc.
18. Installation drawings of all equipment with layout of equipment, cables.
19. Illumination layout of all the indoor & outdoor premises. Layouts at each floor of Electrical/Technological building with details and numbers & locations of light fittings, Lighting distribution boards etc. SLDs of Lighting distribution board.
20. Earthing and lightning protection scheme and layout of earthing and lightning protection network with calculations including special electronics earthing
21. Relay settings with calculations for total network to ensure proper co-ordination.
22. Communication cable (Field bus) routing and procedure for laying of communication cable.
23. QAP for all items covered in this specification

(d) **For Reference / Erection purposes (Electrical)**

1. Schedule of electrics, and their location.
2. HT/LT feeder requirement with individual maximum demand.
3. Control circuit diagrams.
4. Static and dynamic loading of all major equipment
5. External connection diagram (panel wise and scheme wise).
6. Composite drawings showing circuitry of switch-gear remote panels, and other items pertaining to complete circuit for its proper functioning.
7. Power & regulation schemes for AC drives, UPS, soft starter including FCMA type.
8. Motors & field devices.
9. Speed-torque, current vs. time, thermal withstands characteristics for motors.
10. List of interfaces between successful Bidder's equipment and Purchaser's equipment.
11. Cable termination plans with terminal block arrangement and markings.
12. Interconnection diagrams.
13. Internal wiring diagrams of equipment.
14. Fire detection systems: layout & cable list.
15. Motor and electric consumer list.
16. Consolidated Bill of materials and volume of work for erection.
17. Procedure for testing and commissioning of the entire plant, electrical & automation equipment. This shall also be furnished in soft copy.
18. Erection specification with bill of materials of erection materials, earthing materials, junction box, GI conduits etc. This shall also be furnished in soft copy.
19. Spare part list and drawings.
20. Instruction for storage /erection, testing & commissioning.

21. Operation and maintenance manual.
22. Detailed technical literature / catalogue of manufacturers.
23. Graphic display sheets, report/data generation, fault listing etc.
24. Terminal plan drawings
25. System grounding/ earthing scheme.
26. Application software program listings with detailed documentation.
27. Ladder Logic diagram /Statement Lists and software details.
28. Formats and work sheets for generation and display of overview, groups, loops, graphics, alarms, operator's guide messages, real time and historical trends Log and shift formats.
29. List of drawings & spare parts.
30. Final test & calibration certificates and guarantee certificate / warrantee certificate.
31. As built Control description with Operational instruction use of various commands, instruction for control of plant and equipment from Operator workstation.
32. Drawings/documents for inspection of equipment:
    (I) Type test certificate for identical equipment.
    (II) Sub-supplier's/vendor's catalogue/technical literature.
    (IV) Test reports for internal inspection.
    (V) Test certificate of components.
    (VI) Technical specification & data sheets of equipment.
    (VII) All "Approved" drgs./ "Commented" drgs as applicable.
33. Automation systems.
    (I) Software including media and documentation.
    (II) Description of all components of the user system with functional description, overview flow diagram, interface listing, mathematical models, and fault message lists, operator commands, simulation facilities, etc.
    (III) Source code of the user system.
    (IV) Object code of the user system.
    (V) I/O listing
    (VI) Ladder/block diagrams, etc.
    (VII) Factory Acceptance Tests & procedures for PLC/DCS
34. Other Drawings/documents :
    (I) Operation & maintenance manual.
    (II) Catalogues and manuals.
    (III) All "As-built" drawings.
    (IV) Soft copies of all drawings.
    (V) Technical specification/data sheet of equipment.
    (VI) Instructions for storage/erection/testing/commissioning
    (VII) Commissioning report.

(e) **As-built drawings (Electrical)**

Upon installation and commissioning supplier shall incorporate revisions/ modifications if any in the reproducible and submit 'as built' drawings for purchaser's record as per general condition of contract.

Complete and comprehensive instruction manuals for operation and maintenance of the equipment with drawings. This shall include the following:

1. Log sheets indicating daily/hourly recordings of power system parameters to be noted down by customers operating personnel. The parameters shall indicate loading of various electrical equipment quality of power supply, energy consumption of various units, energy consumption and maximum demand of the plant.
2. Preventive maintenance schedule for equipment.
3. Procedure for shut down and energisation.
4. Safety procedures for safe operation of equipment and complete system.
5. Specification of equipment installed.
6. Test procedure for site tests.
7. All as built drawings.
8. Spares list for each equipment for 2 year operation and maintenance.
9. Soft copies of all as built drawings along with hard copies shall be submitted during commissioning.

(Vii) LIST OF DRAWINGS & DOCUMENTS (Automation)

Following drawings and documents shall be submitted by the Bidder:

(a) To Be Submitted Alongwith Offer

1. System configuration diagram for the Automation system along with its peripherals. Configuration should indicate nos. of Processors & interfacing details with plant PLC.
2. Bill of quantities of all hardware & peripherals viz; CPU, I/O units, communication & power supply modules, operator/engineering stations, bus cables & erection accessories etc. offered for the automation system with brief specification.
3. Detailed technical catalogues & a write-up explaining the system offered shall also be submitted along with details of various software being considered.
4. Total power requirement & heat load for automation system.
5. List of commissioning spares with details.
6. List of two years operation & maintenance spares with details & unit rates.

(b) To Be Submitted By The Successful Bidder During Detailed Engineering

(I) FOR APPROVAL:

1. Finalised system configuration diagram for the automation system along with its peripherals with list of hardware and write-up on the system.
2. Bill of Materials & Data Sheets of all the hardwares i.e. Processors, Communication modules, Power supply cards, RLM, OLM, Operator stations, Eng Stations, Servers, Bus cables etc.

3. Overall General arrangement drawings & sectional views of various cabinets, panels, consoles, etc., showing internal disposition of all components/ units, with dimensional details and bill of materials.
4. Interfacing details for interfacing with mail PLC.
5. Single line power supply diagram with specification and bill of quantities of electrical accessories.
6. Quality assurance plan & Factory Acceptance Test procedures for Automation system.
7. Control room layout drawing showing disposition of panels, consoles, desks, etc with dimensional details.

(II) For Scrutiny And Reference

1. Detailed technical literature/ catalogue for Automation system with peripherals, highlighting the model number.
2. Input/ Output list.
3. Terminal diagram of all the Marshalling panels.
4. Cable schedule and specification.
5. System grounding scheme.
6. Formats and work sheets for generation and display of overview, groups loops, graphics, alarms, operator's guide messages, real time & historical trends, log & shift formats.
7. Detailed listing of application software, system software, HMI software, etc and the number of licenses.
8. Application software formats and details in documentation and CDs.
9. Manufacturer's test, calibration and guarantee certificates for all instruments and automation system.
10. Operation and maintenance manuals for Automation system.
11. As-built documentation.

7.0 TECHNICAL SPECIFICATION FOR MOTORS

1 **Low voltage squirrel cage induction motors :**
2 **Low voltage slip ring induction motors (Only for cranes and mill duty):-**

Sl.No.	Parameters	Description
1.0	**Standard**	IPSS 1-03-001 / IS 325 / IEC 34 & IEC 72
2.0	**Constructional Features**	
(i)	Frame size & rating	As per IS 325
(ii)	Motor body	Grey iron casting as per IS:210-1978
(iii)	Motor Feet	Integrally cast with the stator
(iv)	Body Design	-Prevent breakage or other failures due to vibrations normally encountered in heavy industries . -Motors shall be of weather proof construction. -Designed to operate in the humid air stream -Drain plugs to be provided .
(v)	Protection for Motor & Bearing	IP -55 (with canopy for motor if installed outdoor)
(vi)	Shaft ends & Extension	Cylindrical as per requirement Proper drilling and tapping shall be provided for mounting of tachos for speed feedback (if required) Crane motor in 225 and above frame sizes shall have tapered shaft (1:10) (New point)
(vii)	Bearings	-For motor of rating upto 5 kW, ball bearings shall be used for both DE & NDE end. -For ratings above 5 kW the DE end shall be provided with roller bearing and NDE end shall be provided with ball bearing. -Bearings for motors shall be of C3 clearance . -Bearings shall be suitable for running of motor in either direction.
(viii)	Hazardous Area safety design	As per requirement
(ix)	Canopy	To be provided for all outdoor motors .
(x)	Greasing point	At DE & NDE sides .
(xi)	Paint shade	Light grey shade 631 as per IS:5 or RAL 7030 (grey).
(xii)	Direction of Rotation	For crane and mill duty motors : reversible For general purpose continuous duty motor : Bidirectional (New point)
3.0	**Terminal box**	
(i)	Location	Location on top preferably
(ii)	Suitability	-4 Core Aluminium Cable -Extension shall be done to receive the aluminium cables to avoid cramping of the cables in the terminal box .

(iii)	Rotation	4 X 90 deg.
(iv)	Earthing stud	Inside Terminal Block
4.0	**Cooling**	-TEFC -Effective irrespective of direction of rotation
5.0	**Quality of operation**	
(i)	Vibration intensity	Shall be limited as per IS 12075-1986.
(ii)	Noise level	As per IS: 12065-1987
(iii)	Balancing	Motors shall be dynamically balanced with full key on the shaft-end and fan
6.0	**Electrical design**	
(i)	Power Supply	• 415 V +10 & -15% • 50 Hz +/-6% • 3-phase, 4-wire AC • 50 kA for 1 second, solidly earthed.
(ii)	Starting	DOL
(iii)	Min Voltage for Start & Run	85 % of rated voltage at terminal
(iv)	Starting Torque	>= 160 % Rated Torque
(v)	Breakdown or pullout torque	Minimum 275 % of the rated torque
(vi)	Starting current	<= 600% Rated current
(vii)	Duty	S1/ ……or as specified in TS For crane duty S5 40% with 150 start/hour. For conveyor application S-3 and 6 starts / hr For continuous duty-efficiency class EFF-1.
(viii)	Starts/Hour permissible	3 equally spread or 2 in quick succession from cold or one hot start, under rated load condition..
(ix)	Max speed permissible	120% over speed for 2 minutes
(x)	Overload capacity	Capable of withstanding 60% Overload for 15 sec.
(xi)	Efficiency	All continuous duty motor (S1-100%) shall be of high efficiency confirming to eff2 class as per IEEMA-192000 .
(xii)	Derating	Motor designed at 50 deg.C shall be derated suitably for mentioned ambient temperature .
(xiii)	Motor connections	Motor with frame size 90 shall be connected in star and of frame sizes more than 90 shall be connected in delta . For delta connected motors 6 leads shall be brought out .
(xiv)	Insulation	Class F
(xv)	Minimum Permissible temperature rise	Limited to class 'B' (120 deg absolute)
(xvi)	Torque Type	Normal / High / High slip type / Stall Torque type (as required for the specific application)
(xvii)	Space Heater	Out door motors above 45 kW Indoor Motor above 110 kW

(xviii)	No. of Poles	4 pole (unless specific drive requirement or economics call for other poles).
(xix)	Testing	As per approved QAP during engineering stage .
(xx)	Mounting	Normally horizontally foot mounting . Other type of mounting as per specific requirement .

Sl.No.	**Parameters**	**Description**
1.0	**Standard**	IPSS:1-03-001-92, IPSS 1.03-004-93 , IS 325 , IEC 34 & IEC 72
2.0	**Application**	Slip ring induction motors shall be used only for drives of charging cranes . Slip ring motors shall be employed for intermittent duty drives requiring frequent switching operations and speed control and for heavy drive applications requiring high starting torque and meeting frequent overload conditions.
3.0	**Constructional Features**	
(i)	Frame size & rating	As per IS 325 Use of motors in frame sizes above 400 shall be avoided on cranes .
(ii)	Motor body	Grey iron casting as per IS:210-1978
(iii)	Motor Feet	Integrally cast with the stator
(iv)	Body Design	-Prevent breakage or other failures due to vibrations normally encountered in heavy industries . -Motors shall be of weather proof construction. -Designed to operate in the humid air stream -Drain plugs to be provided . -All motors to have continuously rated slip rings.
(v)	Protection for Motor & Bearing	IP55 degree of protection as per IS : 4691.
(vi)	Shaft ends & Extension	-Shall be of high grade steel . -Cylindrical as per requirement -Proper drilling and tapping shall be provided for mounting of tachos for speed feedback (if required) in non drive end or shaft shall be extended with different diameter and length . Tapered shafts for all crane drive motors shall be provided. Motors in 225 and above frame size shall have tapered shaft (1:10) . -Provision of double identical shaft extension (cylindrical & taper) to be made (in case of requirement for a particular application) .

(vii)	Slip rings	– All motors to have continuously rated slip rings. – Phosphor bronze or steel slip rings shall be provided .Cast iron slip-rings shall not be used . – Brush holders shall be in a complete assembly unit . – Slip ring unit shall have a cover with inspection window . – For higher range of motors, separate disc is provided between the slip ring and rotor windings to prevent carbon dust ingression into windings.
(viii)	Bearings	-For motor of rating upto 5 kW, ball bearings shall be used for both DE & NDE end. -For ratings above 5 kW the DE end shall be provided with roller bearing and NDE end shall be provided with ball bearing. -Bearings for motors shall be of C3 clearance . -Bearings shall be suitable for running of motor in either direction.
(ix)	Hazardous Area safety design	As per requirement
(x)	Canopy	To be provided for all outdoor motors .
(xi)	Greasing point	At DE & NDE sides for online greasing facility without dismantling the motor.
(xii)	Paint shade	Light grey shade 631 as per IS:5 or RAL 7030 (grey).
4.0	**Terminal box**	
(i)	Location	On top preferably
(ii)	Suitability	-4 Core Aluminium Cable -Extension shall be done to receive the aluminium cables to avoid cramping of the cables in the terminal box.
(iii)	Rotation	4 X 90 deg.
(iv)	Earthing stud	One earthing stud shall be provided in the terminal box and two terminals on mounting feet.
(v)	Stator and rotor connections	Separate and distinctly marked terminal box to be provided for stator and rotor connections.
(vi)	Protection class	IP 55 in all the cases .
(vii)	Cable glands	Suitable for double compression type cable glands .
5.0	**Cooling**	-TEFC design only -Effective irrespective of direction of rotation -The cooling code of motor is IC 411 as per IS : 6362.
6.0	**Quality of operation**	
(i)	Vibration intensity	Shall be limited as per IS 12075-1986.
(ii)	Noise level	As per IS: 12065-1987
(iii)	Balancing	Motors shall be dynamically balanced with full key on the shaft-end and fan

7.0	**Electrical design**	
(i)	Power Supply	• 415 V +10 & -15% • 50 Hz +/-6% • 3-phase, 4-wire AC, • 50 kA for 1 second, solidly earthed.
(ii)	Starting	DOL or thyristor converter (ASTAT or SIMOTRAS or equv.) Soft starter feature through static voltage control/VVVF as per application
(iii)	Min Voltage for Start & Run	80 % of rated voltage at terminal
(iv)	Breakdown or pullout torque	Pull out torque of the intermittent duty motors to be not less than 300% of the rated torque at 40% duty factor.
(vi)	Starting current	<= 600% Rated current
(vii)	Duty	Duty cycle shall not be less than S4-40% , with a minimum of 150 starts per hour (600 starts / hour for charging cranes and other process cranes) . For conveyor application S-6 duty.
(viii)	Starts/Hour permissibe	Mechanically and electrically shall be suitable for required number of switching / reversals or starts per hour.
(ix)	Max speed variation	250 % of rated synchronous speed at high accelerating rates and rapid reversals .
(x)	Max speed	250 % of rated speed or 2000 rpm whichever is less .
(xi)	Rated synchronous speed	Motors shall be of low synchronous speed for ease of dynamic balancing of hoist rotating unit . The motor speed preferably shall be as follows : Upto 37 KW :1000 rpm Above 37 KW upto 90 KW :750 rpm Above 90 KW :600 rpm
(xii)	Overload capacity	1.5 times the rated current for 2 minutes
(xiv)	Void	
(xvi)	Derating	Motor designed at 50 deg.C shall be derated suitably for mentioned ambient temperature .
(xvii)	Insulation	Class H
(xviii)	Torque Type	Normal / High / High slip type / Stall Torque type (as required for the specific application)
(xix)	Space Heater	Out door motors above 45 kW Indoor Motor above 110 kW
(xx)	Over temperature detection and protection.	Slip ring motors for essential drives to be provided with Pt 100 resistance thermometers / thermocouples or thermistors .
(xxi)	No. of Poles	Not applicable
(xxii)	Testing	As per approved QAP during engineering stage .

(xxiii)	Mounting	Normally horizontally foot mounting . Other type of mounting as per specific requirement .
(xxiv)	Derating	Motors shall be derated considering all the factors – variation in voltage and frequency . – Ambient temperature – Thermal ability due to constant and variable losses of the motor – Type of load driven

03. HIGH VOLTAGE SQUIRREL CAGE INDUCTION MOTORS

Sl.No.	**Parameters**	**Description**
1.0	**Standard**	**IPSS 1-03-018/IS 325**
2.0	**Constructional Features**	
i).	Frame size & rating	As per IS 325
ii)	Stator Frame	Fabricated Steel / High grade cast Iron
iii)	Stator Core	Laminated sheets of high grade low loss silicon steel
iv)	Motor body	Grey iron casting as per IS:210-1978
v)	Casing Feet	Integral with the motor frame
vi)	Body Design	Prevent breakage or other failures due to vibrations normally encountered in heavy industries
vii)	Protection for Motor & Bearing	IP – 55 as per IS 4691-1985.
viii)	Shaft	Forged Steel shaft
ix)	Bearings (below 1000kW)	Anti-friction Bearing with Regreasing facility & with grease quantity controllers
	Bearings (1000kW & above)	-Pedestral type sleeve bearing with forced oil lubrication. (Arrangements to be incorporated to prevent lubricating oil from reaching the windings) . -Bearing temperature, lubricating oil temperature and pressure to be measured and monitored .
x)	Vibration monitor	Shall be provided at the DE end of motor bearing
xi)	Pedestals insulation	Against circulating shaft currents
xii)	Hazardous Area safety design	NA / as specified
xiii)	Indication of direction of rotation	By Arrow blocks on non-driving end

xiv)	RTD & BTD (PT100 type)	– All motors shall be provided with Bearing (DE & NDE) temperature detectors and 6 nos. stator winding temperature detectors, RTDs for monitoring alarm and trip conditions. RTD's shall be of PT100 type (duplex). – Analog input cards shall be provided in PLC for online monitoring of bearing (DE & NDE) and winding temperature of HT motors above 1000 KW . – For HT motors, temperature of each RTD (for winding / bearing) shall be wired to PLC system and limit value contacts for alarm and tripping shall be generated in the PLC along with the display of all parameters of the motor including the winding and bearing temperature.
xv)	Vibration monitoring	– Vibration monitoring (online) shall be provided at the DE end of motor bearing for motors of ratings 1000 kW and above and it should be connected to PLC for online monitoring .
xvi)	Paint shade	– Light grey , shade no. 631 as per IS 5
3.0	**Terminal box**	
i)	Protection	IP -55
ii)	Type	Phase segregated
iii)	Location	As per requirement 1 no. each on opposite sides of motor.
iv)	Winding star point	– Winding star point shall be kept outside in the motor for more than 200 KW HT motor and other important HT motor . – In case no differential protection is required, star point of the winding may be formed inside the neutral terminal box to be provided on one side of the motor. The phase segregated terminal box shall be placed on other side of the motor.
v)	Suitability	– Termination of XLPE cables with heat shrinkable cable end seals. – Each terminal box to have two inlets to accommodate any parallel cables as required.
vi)	Reversible	To suit cable entry from Top / Bottom
vii)	Earthing stud	Inside TB for protective earth conductor termination
viii)	No. of terminal boxes	Separate for Space heaters, RTDs / BTDs , Vibration monitor etc
ix)	Fault withstand (Min.)	Rated Short circuit level of the system voltage for 0.25 sec
4.0	**Cooling**	TEFC / CACA / CACW CACW system shall be complete with temperature and pressure monitoring devices.

5.0	**Quality of operation**	
i)	Vibration intensity	Limited to 37.5 micron peak to peak.
ii)	Noise level	Continuous noise level should not exceed 85 db A at a distance of 1.0 m from the motor body as per IS: 12065-1987.
iii)	Balancing	Dynamically balanced with full key on shaft end and fan
6.0	**Electrical design**	
i).	Efficiency	High efficiency design of 96% at Full load
ii)	Starting	DOL
iii)	Min Voltage for Start & Run	80 % of rated voltage at terminal
iv)	Starting Torque	As specified in application
v)	Starting current	<= 600% Rated current
vi)	Duty	S1
vii)	Starts permissible	3 successive start from cold condition OR 2 successive start from hot condition.
viii)	Starts / hour	3 equally spread in normal Voltage, Frequency & Load
ix)	Max speed permissible	150 % rated for 2 minutes
x)	Differential protection	Required for1000 kW & above
xi)	Insulation	Class F & confirming to IEC 34 -15/1990
xii)	Insulation Material	Cast resin rich / VPI
xiii)	Minimum Permissible temperature rise	Limited to class 'B' (120 deg absolute)
xiv)	Space Heater	Required & automatically off during RUN
xv)	No. of Poles	4 (or as mentioned specifically)
xvi)	Locked rotor current withstand time	5 sec longer than starting time under rated load condition.
xvii)	Surge protection	As specified
xviii)	Operational design	Suitable to VCB Breaker
xix)	Motor winding and inter turn insulation, connections and leads:	Shall be fully insulated using mica insulation. For such motors surge absorbers (with non-linear resistance) shall be provided within 10 to 15 meters from the motor terminals to limit the over voltages. OR In case mica is not provided in motor insulation, both surge capacitors and surge absorbers (with non-linear resistance) shall be provided within 10 to 15 mtrs from the motor terminals to limit the over voltages and rate of rise of voltage

04. SYNCHRONOUS MOTORS

2.0	**Constructional Features**	
i).	Frame size & rating	As per IS 325
ii)	Stator Frame	Fabricated Steel / High grade cast Iron
iii)	Stator Core	Laminated sheets of high grade low loss silicon steel

iv)	Motor body	Grey iron casting as per IS:210-1978
v)	Casing Feet	Integral with the motor frame
vi)	Body Design	Prevent breakage or other failures due to vibrations normally encountered in heavy industries
vii)	Protection for Motor & Bearing	IP – 55 as per IS 4691-1985.
viii)	Shaft	Forged Steel shaft
ix)	Bearings (below 1000kW)	Anti-friction Bearing with Regreasing facility & with grease quantity controllers
	Bearings (1000kW & above)	-Pedestal type sleeve bearing with forced oil lubrication. (Arrangements to be incorporated to prevent lubricating oil from reaching the windings) -Bearing temperature, lubricating oil temperature and pressure to be measured and monitored .
x)	Vibration monitor	Shall be provided at the DE end of motor bearing
xi)	Pedestals insulation	Against circulating shaft currents
xii)	Hazardous Area safety design	NA / as specified
xiii)	Indication of direction of rotation	By Arrow blocks on non-driving end
xiv)	RTD & BTD (PT100 type)	– All motors shall be provided with Bearing (DE & NDE) temperature detectors and 6 nos. stator winding temperature detectors, RTDs for monitoring alarm and trip conditions. RTD's shall be of PT100 type (duplex). – Analog input cards shall be provided in PLC for online monitoring of bearing (DE & NDE) and winding temperature of HT motors above 1000 KW . – For HT motors, temperature of each RTD (for winding / bearing) shall be wired to PLC system and limit value contacts for alarm and tripping shall be generated in the PLC along with the display of all parameters of the motor including the winding and bearing temperature.
xv)	Vibration monitoring	– Vibration monitoring (online) shall be provided at the DE end of motor bearing for motors of ratings 1000 kW and above and it should be connected to PLC for online monitoring .
xvi)	Paint shade	– Light grey , shade no. 631 as per IS 5
3.0	**Terminal box**	
i)	Protection	IP -55
ii)	Type	Phase segregated

iii)	Location	– RHS viewed from DE / On top – 01 nos. each on opposite sides of motor in case of Differential Protection (or not) / Neutral TB opposite to main TB
v)	Suitability	– Termination of XLPE cables with heat shrinkable cable end seals. – Each terminal box to have two inlets to accommodate any parallel cables as required.
vi)	Reversible	To suit cable entry from Top / Bottom
vii)	Earthing stud	Inside TB for protective earth conductor termination
viii)	No. of terminal boxes	Separate for Space heaters, RTDs / BTDs , Vibration monitor etc
ix)	Fault withstand (Min.)	Rated Short circuit level of the system voltage for 0.25 sec
4.0	**Cooling**	TEFC / CACA / CACW CACW system shall be complete with temperature and pressure monitoring devices.
5.0	**Quality of operation**	
i)	Vibration intensity	Limited to 37.5 micron peak to peak.
ii)	Noise level	Continuous noise level should not exceed 85 db A at a distance of 1.0 m from the motor body as per IS: 12065-1987.
iii)	Balancing	Dynamically balanced with full key on shaft end and fan
2.0	**Design**	Motors shall be of cylindrical design with brush less excitation system and automatic voltage and power factor regulation.
3.0	Power factor	0.9 or better.
4.0	Motor winding	Motor stator winding braced for full voltage starting. Squirrel cage type winding with short circuited rotor bars for producing starting torque and accelerating torque to bring the synchronous motor upto the speed All the three windings stator , rotor and exciter shall be VPI (Vacuum pressure impregnation) .
5.0	Bearings	Small frame size motors shall have endshield bearings and large motors shall have pedestral bearings .
6.0	Cooling	All the three modes of cooling arrangement as per requirement • Open air (for the areas where air is relatively clean e.g water supply pump houses) • Air to water (in closed cooling circuit) • Air to air cooling (ID fan etc.) . A shaft mounted fan or a separate fan to be provided for air circulation .

7.0	Excitation method	Brushless excitation system (Integral exciter and rotating rectifier assembly to eliminate the need for brushes and slip rings both on exciter and motor respectively) .
8.0	Automatic system power factor correction.	Motor field to have micro processor based thyristor controlled static excitation system (for automatic system power factor correction).
9.0	Motor synchronism protection	Field monitor relay to be provided for monitoring the power factor of the system which in turn trips the motor and the exciter field off if synchronism is not achieved within a specific length of time or if the motor pulls out of step .
10.0	Insulation class	Class F insulation for field windings as well as for stator with temperature rise limited to 70 deg. C (as measured by resistance method) over an ambient of 50 deg. C.
11.0	Locked rotor withstand time	Motors shall be capable of withstanding locked rotor current for atleast 5 second longer than starting time under rated load condition.
12.0	Starting method	DOL / Auto transformer starting method / Load commutated inverter (LCI)
13.0	Space Heater	Space heater to be provided.

8.0 TECHNICAL SPECIFICATION FOR VARIABLE FREQUENCY DRIVE (VFD)

1.0	Basic design particulars	- Digital control technology with vector control (with / without PG as per requirement) . - IGBT based with sine coded PWM control. - VFD shall communicate to basic automation system on system communication bus . - Suitable for variable torque or constant torque applications requiring harmonic control as defined by IEEE 519-1992. - The drive shall have an internal EMC filter capable of meeting the Second Environment levels for the EMC directive without the need for additional components. - Shall confirm to IEC 146 -International Electrical Code. - For 4 quadrant operational drives , active front end type VFD shall be provided . - Where speed control I desired for production and quality control VFD isto be provided . - Where speed control is not required sof t starter or motor intelligent controllers are to be provide.
2.0	Drive controller technology	Software configurable to either V/Hz (single or multi motor) mode or Sensorless Dynamic Torque Vector mode (single motor). -Full, closed loop flux vector control shall be available for constant torque applications. - Operating the drive with motor disconnected. - Adjustable PWM carrier frequency within a range of 3 – 15 KHz. -Suitable for use on both CT & VT loads. -Multiple programmable stop modes including -Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve. -Multiple - acceleration and deceleration rates.

3.0	Type of connection	-Three full wave diode rectifiers supplied by phase shifted, three phase AC to provide a fixed DC voltage. -DC bus inductor on all ratings -DC link capacitors -Insulated Gate Bipolar Transistor (IGBT) power section, shall be rated for variable / constant torque applications. The power section shall use vector dispersal pulsewidth modulated (PWM) IGBT gate control algorithm and soft switching IGBT's to reduce motor terminal dv/dt and allow longer cable length from drive to motor without output filters. -The Main Control Board shall be the same for all ratings to optimize spare parts stocking and exchange -Common control connection for all ratings.
4.0	Overload capacity	-110% of the rated current for 1 minute , 30 seconds at 150% (with inverse characteristics proportional to time) for variable torque applications . Repetition interval shall not be less than 9 minutes -150% of the rated current for 1 minute overload , 30 seconds at 200% (with inverse characteristics proportional to time) and 200% of rated current for 0.5 sec. for constant torque applications . Repetition interval shall not be less than 60 minutes .
5.0	Efficiency	More than 97% or better at full speed and full load.
6.0	Input power supply	-415 V AC +10% & -15% -3 phase . -50 Hz + / -6 % -4 wire neutral earthed system .
7.0	Voltage variation	-Voltage variation of (+/-) 0.1 % with an input variation of +10% -15%. -Steady state regulation of (+/-) 0.25% guaranteed against 100 to 200 % load disturbance and + 6% & -6% input supply frequency variation. -The drive should be designed to operate on an AC supply, which may contain line notching, and up to 10% harmonic distortion.
8.0	**Environmental conditions**	
8.1	Storage ambient temperature range	Upto to 70ºC (-40ºto 158ºF).
8.2	Operating ambient temperature range without derating.	IP42 & above : 0ºC to 50ºC (0ºto 122ºF)
8.3	Relative humidity	Upto 100% non-condensing.
8.4	Operating elevation	Up to 1000 Meters (3,300ft) without derating.
8.5	Shock	15G peak for 11ms duration
8.6	Vibrations	Suitable to withstand vibrations more than 0.5g.
9.0	**Reference**	
9.1	Input reference	O +/-10 V DC / 0 – 10 V DC / 4 – 20 mA .

	voltage	
9.2	Reference signals	The drive should be capable of the following speed reference signals • Digital MOP • Jog • HIM (Program/Control panel) • Analog Input signals • Preset Speeds • Communication module commands All reference signals may have a trim signal applied to them for finer resolution and accuracy. Trim source and amount should be programmable.
9.3	Loss of reference	The drive should be capable of sensing the reference loss conditions . In the event of loss of an analog input reference signal, the drive should be user programmable to the following • Fault the drive • Alarm and maintain last reference • Alarm and go to preset speed • Alarm and go to minimum speed • Alarm and go to maximum speed • Alarm and maintain last output frequency Signal loss detection should be available regardless of the function of the analog input.
10.0	**Output**	
10.1	Output voltage	From 0 to rated motor voltage .
10.2	Output frequency	0.5 -400 Hz.
10.3	Output Waveform	Sinusoidal
10.4	Output frequency resolution	0.01 Hz.
11.0	Reflected wave	Maximum of 3.15 times the bus voltage or 1600V, whichever is less, up to cable lengths of 200 metres.
12.0	Starting torque	150 % / 0.3 Hz. (without PG) 150 % / 0 RPM (with PG)
13.0	Torque accuracy	+ / -5 % .
14.0	Speed control accuracy	+ / -0.02 % . IR compensation to be provided for drive without PG .
15.0	Ramp rate	-Linear acceleration and deceleration adjustable independently from 0 to 3600 seconds . -Provision of remotely selectable Accel / Decel settings should be accessible through digital inputs also.
16.0	Main power components in incoming AC side	-ACB / MCCB with 50 KA rating -Matching input isolation transformer / line reactor for harmonic and noise suppression . For input isolation transformer , the K factor shall be 4.0 or less. -AC line surge suppression network . -Input contactor .
17.0	Converter – Inverter Equipment	-Diode / Thyristor bridge for AC/DC. -DC link circuit with reactor/capacitor -IGBT bridge for Inverter for DC/AC. -Harmonic transformer . -Main PLC to take care of interlocking and sequencing etc. -Mimic panel (where drive is HT)

18.0	Load side components	-Filter network -Electronic over-load relay for each motor (with display). -Line contactors in output side (if required). -Output reactor / terminator (if required)
19.0	Terminal blocks	-Separate for control and power wiring. -Power terminal blocks to withstand a minimum of 90 ºC and marked for both inputs and outputs . -Uniform color-coding to be followed for cabling, TB, etc.
20.0	By-pass Arrangement	By-pass arrangement shall be provided to operate the motor in case of failure of VFD.
21.0	Diode Bridge	Minimum ratings of Diode cells. -PIV rating : 2.5 times the peak value of line voltage -dv/dt rating : 200V/microsecond for voltage control and 1000V/ microsec. for inverter control. -di/dt rating : 100A / microsecond.
22.0	Input / Outputs	• Hardwired I/O should be provided via separate I/O cards -**Standard I/O Card** • The "Standard I/O board should consist of both digital and analog I/O. It should be available in two versions; one for 115/240 VAC digital I/O and one for 24V AC/DC digital I/O. -**Analog I/O** • Differentially isolated ±10V (bi-polar) / 20mA analog inputs . -**Digital Outputs** • Relay outputs – Minimum 04 nos. • Contact output ratings should be 240V AC / 24V DC, Maximum 2.0 Amp
23.0	Protective features	AC line surge suppression network and overvoltage protection . -Under voltage in supply network -Phase sequence protection and monitoring -Single phase failure -Motor loss -Under voltage in DC bus -Over voltage in DC bus -Over speed protection in the event that the output frequency exceeds the maximum reference by a specified amount. -Over load -Earth fault -Instantaneous over current -Transformer fault ,If applicable -Cooling fan failure -Stall monitor for motor alarms -Controlled shut down, when properly fused, with no component failure in the event of an output phase to phase or phase to ground short circuit and annunciation of the fault condition.
24.0	Annunciations	Following faults shall be annunciated in keypad of the drive / HMI . -AC line surge suppression network and overvoltage protection . -Under voltage in supply network -Phase sequence protection and monitoring -Under voltage in DC bus -Over voltage in DC bus -Over speed monitor -Over load -Earth fault

		-Instantaneous over current -Transformer fault ,If applicable -Cooling fan failure – Stall monitor for motor alarms -Motor fault (winding / bearing temperature, vibration) as applicable -Loss of frequency command -Shall be able to store at least 16 previous faults in memory on FIFO sequence . **In addition to annunciations in keypad , a separate annunciation window shall be provided on front door of the VFD panel .**
25.0	Meters	-Output voltmeter and ammeter with selector switches. -Input volt meter and ammeter with selector switches . -Output frequency meter (digital type). -KW meter for drive ratings above 200 KW. All digital display shall be programmable .
26.0	**Other features**	
26.1	Bus Regulation	DC Bus regulation should be available to reduce the possibility of drive overvoltage trips due to regenerative conditions.
26.2	Load dependent current limit	Programmable current limit from .1 amps to 150% of drive rated amps. Current limit to be active for all drive states; accelerating, constant speed and decelerating.
26.3	Dynamic Braking	The drive shall have an internal, built in 7th IGBT for use as a dynamic braking chopper. This IGBT shall have enough capacity to handle greater than or equal to 100% regeneration power from the output, continuously. The drive shall also have a "drive mounted" dynamic braking resistor for low level braking applications and interactive software to protect the "internally" mounted resistor from abuse.
26.4	Fault Memory	16 nos. of faults to be stored on FIFO basis for fault analysis .
26.5	Ride Through	The control logic should be capable of "riding through" a power outage of at least 0.5 seconds in duration. The inverter section should be shut off after an 18% drop in bus voltage to conserve power for the drive logic.
27.0	Selector switches	-Local / Remote . -Auto / Manual . -Main / Bypass . All the selector switches shall be of 10 A rating .
28.0	Pushbuttons	-Trip reset . -Start. -Emergency stop.
29.0	Lamps	-Drive ready . -Drive trip . -R , Y , B phase power ON . -Control supply ON . All the lamps shall be of cluster LED type having low voltage glow protection..

30.0	Regulation & control facilities	-Reference speed setter -Ramp generator -Speed feed back -Current feed back -Flying start - Trigger module -Pulse transformers -Logic control module -Sequence module -PID control -Zero speed / over speed monitor as applicable - Momentary power loss restart . -Auto tuning . - Current limiter -Skip Frequency -Counter current / regenerative braking unit as applicable -Active electronic components used shall be of industrial grade hermetically sealed . -Output signals for fault alarm , frequency arrival , running signal .
32.0	Remote control facilities	-Shall have transducer to monitor the outputs like motor speed at remote place / HMI . -Facility to accept speed reference from HMI / engineering station.
33.0	Auto / Manual Mode	-The HIM should utilize the ALT function key to transfer the drive from Automatic mode to Manual mode and back. -When in Auto mode, the drive to receive its frequency command from the programmed source. -When in Manual mode, control of the frequency command to be transferred to the HIM speed control keys (or potentiometer). -The user should have the choice of preloading the HIM with the current "auto" frequency reference before transferring control to allow for smooth transitions without speed "jumps".
34.0	Communication Bus	RS485 (ModBus, ProfiBus-DP, DeviceNet) bus Internally mounted interfaces shall be provided to connect to different buses .
35.0	Test points	Two electronic test point parameters should be available to examine data within the drive memory that is not available through other parameters.
36.0	Operator panel	Shall be mounted on the front door of the unit . IP 66 protection class . -All adjustments to be made with the door closed. -Status and Power LEDs viewable through the cover -Status LEDs for communications status, including embedded DPI status, adapter health and communications network status, viewable through the cover .
37.0	Membrane keypad	-The keypad shall be logically designed for two operating areas with required number of keys. - Local operator control like -local start /stop , -jog forward / reverse . -Programming . Facility to run the drive without HIM shall be provided .

38.0	LCD display	-Display shall be black lighted , enabling viewing in extremes of lighting conditions -Display shall be in alphanumeric (in English only) -21 characters , 7 lines . -All the faults stored in memory shall be displayed by scrolling .
39.0	Construction features	-Floor mounted, free standing -Dust and vermin proof -Sheet steel clad -Minimum 2.5 mm thick for panels. -Minimum 2.0 mm thick for doors and side covers. -Suitable to withstand vibrations to be encountered in steel plant application. -Cubicles with illumination lamps, door switches, space heaters and adequate sockets for soldering. -All control blocks plug–in-type with necessary test sockets. -Units shall be self contained and serviceable.
40.0	Enclosure and ventilation	-Enclosure conforming to IP-42 or better with weather proof enclosures -Units shall be provided with cooling fans and louvers at the bottom sides with filters. All louvers shall have fine mesh filter behind them. - bottom not acceptable. - For larger drives cooling fans of drives shall be powered from different power source .

9.0 TECHNICAL SPECIFICATION FOR STAND ALONE STARTER

A. General :		
1.0	Type	-Metal clad . -Non drawout type.
2.0	Construction	-Modular construction . -Fully compartmentalized with metal / insulating material partition.
3.0	Enclosure class	IP52.
4.0	Type of execution	Single front.
5.0	Mounting	-Floor mounting. -Free standing with ISMC 75.
6.0	Installation	Indoor.
B. Constructional Features :		
1.0	Sheet steel	
	Thickness	-2 mm for load bearing members. -1.6 mm for non load bearing members.
	Material	CRCA
2.0	Cable entry	-Incomer :Bottom cable entry. -Outgoing :Bottom cable entry.
3.0	Design	-Rear access through removable rear hinged cover door. -All the components shall be accessable from front .
4.0	Interlocking & protection	-Module door interlocked with main power isolating devices. -Power circuit isolation device to have pad locking in the OFF position with door closed.
5.0	Operating height	-Minimum :-300mm -Maximum :-2000 mm.
6.0	Gland plate	Undrilled removable bottom gland plates (3 mm thick)
7.0	Miscellaneous	-Neosprene rubber gasket shall be provided for all the doors , removable covers & between adjacent covers . -Lifting hooks for the panel . -Doors shall have concealed hinges .
8.0	Labelling	Clear legible identification labels (anodized aluminium with white letters engraved on black background) with letter sizes of :-25-50 mm for panel . -5 mm for components and module name plates. -Danger board on front and rear sides in English , Hindi and local language
9.0	Earthing	-Two separate earthing terminals will be provided. -Bolted joints with tooth spring washers for good earth continuity.
10.0	Paint shade	Shade No. 631 as per IS-5:1992 equv to RAL 7035 .
11.0	Panel space heater	In each panel with thermostat , MCB .
C. Busbars		
1.0	Arrangement	Three phase & neutral.
2.0	Material	High conductivity electrolytic aluminium alloy confirming to grade E91E as per IS-5082 –1981.
3.0	Phase Busbar Rating	-Shall be able to carry continuously the connected load (considering all derating factors) plus a 25% margin . -Max. current density shall be -1.0 A/sq.mm for Aluminium -1.5 A/sq.mm for Copper.

4.0	Neutral Busbar Rating	50 % of phase busbar rating
5.0	Short circuit rating	50 KA for 1 sec.
6.0	Busbar configuration	Red-yellow-blue from front to back or top to bottom or left to right as viewed from front.
7.0	Busbar insulation	Heat shrinkable PVC -R,Y,B coloured sleeves for phases -Black for neutral.
8.0	Busbar supporting insulators	-Non-hygroscopic -Flame retarded -Track resistant -High strength -Sheet moulded compound or equivalent polyster fibre glass moulded type .
9.0	Max. temp. rise of bus	Not to exceed 35 deg. C. above ambient of 50 deg.C.
10.0	Air clearance for bare busbar	Phase to phase :25.4 mm (minimum) Phase to earth :19.0 mm (minimum)
11.0	Joints and tap off points	-Busbar joints and tap off points shall be shrouded and bolted (with cadmium coated bolts with plain and spring washers and locknuts). -Bimetallic connectors for connection between dissimilar metals . -Antioxide grease for all bus connections
12.0	Neutral bus isolation	Through disconnecting link .
13.0	Busbar access	Rear side
(ii) Earth bus		
1.0	Material	GI.
2.0	Size	Minimum 50 x 6 mm with extension at both ends.
(iii) Control bus		
1.0	Material	Copper.
2.0	Size	Minimum 25 x 3 mm .
D. Insulation level		
1.0	Rated insulation voltage	1100 V
2.0	Impulse withstand voltage	4 KV as per IS-13947 (Part I) 1993
3.0	One minute power frequency withstand voltage	2.5 KV for power circuit & 500 V for control circuit
E. Pollution Degree		
1.0	Pollution Degree	Pollution Degree 3 as per IS-13947 (Part-1) : 1993 ; unless otherwise stated
F . Components		
1.0	Isolating Equipment	3 pole MCCB (upto 630A)
2.0	Indication Lamps	LED type indicating lamps for :-MCCB ON/OFF/TRIP. -Power ON R / Y / B .
3.0	Meters and selector switches	-96 sq.mm size voltmeter with 7 position selector switches -96 sq.mm size ammeter with 4 position selector switches
4.0	Power contactor	-AC3 duty of rated capacity .

5.0	Intelligent motor controller	-As defined in clause no. 1.02.08 .
6.0	Motor protection relay (for non intelligent panel)	-Microprocessor based. -Suitable for 5A & 1A - Protections • Short circuit • Overload • Earth fault • Stalling protection • Undervoltage • Overspeed • No.of starts per hour (cold & hot) -Communication facility with PLC. -Memory for • Storing fault history & trending
7.0	Auxiliary contactors	-Shall be provided for logic operation and operating sequence . -Shall have minimum 2NO+2NC auxiliary contacts.
G. Panel Wiring		
1.0	Power / current transformer circuit	1.1Kv grade single core , black colour PVC insulated , stranded copper conductor of minimum size 2.5 sq.mm.
1.0	Power / current transformer circuit	1.1Kv grade single core , black colour PVC insulated , stranded copper conductor of minimum size 2.5 sq.mm.
2.0	Control and potential circuit	-1.1Kv grade single core -Black colour PVC insulated - Stranded copper conductor of minimum size 1.5 sq.mm.
3.0	Ferrules	-Numbered plastic/ceramic ferrules. -Self locking type.
4.0	Marking	-Wiring will be properly marked as per relevant IS.
5.0	Spare contacts	-All spare contacts of relays selector switches & contactors will be wired upto the terminal block. -Each components shall have at least one potential free spare contacts.
6.0	Terminals	-Power & control terminals shall be segregated by insulating material like hylam / bakelite sheet. -Power terminals shall be stud type. -Control terminals shall be suitable for connecting two cores of 2.5 sq.mm wires. -Minimum 20 % spare terminals shall be provided. -The minimum rating of control terminal shall be 10 Amps. -Color coded wires, TB's of different voltage rating to be provided . -Uniform color-coding to be followed for cabling, TB, etc.
7.0	Cable glands	Double compression cable glands for receiving external power and control cables
I. Control Supply		
1.0	Control transformer	1 nos. of 415V/240V control transformer of minimum 2.5 KVA Secondary unearthed.
2.0	Input and output side isolation device	Input side :MCB Output side :MCB Output side :MCB Output side :MCB

10.0 SPARES

(A) Commissioning Spares and Insurance Spares

Supply of commissioning spares and insurance spares as required shall be in scope of supply of the Bidder alongwith the equipment. The list of commissioning spares and the insurance spares as per the format as given in SBD shall be furnished alongwith the tender. It shall cover requirements of erection, cold tests, startup and initial operation of the plant till integrated testing & successful commissioning and commencement of commercial production up to a period of six months. Any leftover commissioning spares shall be the property of the Purchaser. Any commissioning spares required over and above the list given by the Bidder shall have to be provided by the Bidder free of cost up to the successful commissioning & commencement of commercial production of the plant and equipment. The Bidder shall supply adequate insurance spares to ensure smooth operation and maintenance of the plant.

(B) Consumables

The Bidder shall supply all consumables such as initial fill of lubricants, oils, grease, chemicals, refractories, resins etc. as required to complete the plant till commissioning and shall have a shelf life of minimum one year. The scope of consumables shall include electrodes, shims, packings, bolts, nuts, gaskets, rivets, washers etc. The Bidder shall fulfill the requirement given in SBD.

The Bidder shall also furnish Indian equivalent of oils, lubricants, refractories and other consumables along with necessary specifications, drawings, catalogues etc. to enable the Purchaser to procure them from indigenous sources.

The Bidder shall indicate the annual requirement of all such consumables.

(C) Operating, Maintenance and Two Years' Spares:

(1) The Bidder shall ensure the interchangeability of the parts wherever possible. The Bidder shall furnish an itemized list of interchangeable spares as given in SBD.

(2) The list of spares as necessary and recommended by the respective manufacturer for two years' of reliable and trouble free operation and maintenance of all equipment under this package shall be in the scope of the Bidder. The same shall be quoted separately. In the event of order the successful Bidder shall furnish complete specification of the same.

(3) Spares list giving complete list of the replaceable parts, fully illustrated, shall be supplied. The list shall include the following information.

- Item designation
- Reference drawings
- Quantity installed
- Quantity recommended for two years' normal operation including the insurance spares
- Weight of each spare part
- Supplier or sub-supplier's catalogue number
- Recommended minimum stock
- Expected replacement time
- Installation instruction in detail shall be supplied both for original installation and future, for replacement of major electrical equipment, circuit wiring diagram shall be provided.

(D) Special Erection / Maintenance Tools and Tackles:

(1) The Bidder shall supply a complete and unused wet of all the special tools and tackles including required number of tool boxes as required for erection, maintenance, overhaul or complete replacement of the equipment and components required for the plant. The Bidder shall submit a list of such special erection and maintenance tools and tackles.

(2) All the tools shall be supplied in separate containers clearly marked with the name of the equipment for which they are intended.

(3) The Successful Bidder shall indicate list of construction machineries, handling equipment and other facilities including tower crane or equivalent for erection at high elevation required for the execution of work based on their previous experience, considering site conditions and other considerations of work and furnish resource deployment plan. The successful Bidder shall mobilize these equipment at site for the execution of work and this is an important requirement of the project. The availability of required facilities shall be ensured for completeness of the project in time.

(4) For any fabrication / control assembly (necessary for erection) work to be done in the plant premises the plan shall be indicated by the Bidder. The necessary equipment such as plate bending machines, special purpose welding machines, fixtures, tools & tackles and other equipment required for fabrication shall be arranged by the successful Bidder.

(5) The successful Bidder shall carry out the testing of welded joints by radiographic and ultrasonic methods. They must have only qualified / certified welders with them for completing all the welding jobs.

(6) All the measuring instruments shall be calibrated having reference to NPL (National Physics Laboratory).

(7) All tools and tackles, apparatus, special instruments required for erection, testing, commissioning and establishment of the Performance Guarantee Test, measurements required for establishing the pollution control norms and such other instruments, as required, shall be arranged by the successful Bidder. After commissioning, the successful Bidder shall handover all the special tools & tackles to the Purchaser as per the requirement given in SBD.

(8) The successful Bidder shall supply all required consumables, initial fill, oil, lubricants, construction and erection materials including but not limited to shims, packing plates, joining compounds, kerosene, solvents, sealing compounds, tapes, connectors, brazing and soldering materials, welding and brazing gases and rods, electrodes and wires, erection bolts, nuts, rivets, piano wire, packing sheet and packing compounds, temporary supports, spacer templates, jute and cotton waste cloth, sand and emery paper etc. for the commissioning of the plant.

(9) For load testing of handling equipment, loads shall have to be arranged by the successful Bidder. Electrical/ operation tests, as per standard practice, shall also be arranged and completed by them.

(10) All materials, equipment, tools, tackles etc. brought at site by the successful Bidder within the plant area shall not be removed without the written permission of the Purchaser. Similarly, all enabling works built/erected and/or acquired by them within the plant premises shall not be dismantled and removed without the written permission of the Purchaser.

(E) General tools and tackles A list of general tool and tackles to be supplied shall be indicated as per the format given in schedule at Chapter 12.

(F) Information/ Data on Spares and Consumables

The list of Spares & consumables shall be furnished by the successful Bidder as required in SBD. However, the successful Bidder shall furnish various information regarding spares, consumables, tools & tackles etc. as per the schedules indicated in chapter 12 of this Technical Specification.

DATA SHEETS

11.0 TECHNICAL DATA SHEET (To be filled by the vendor)

(A) TECHNICAL DATA SHEET (Mechanical)

The Bidder shall also fill up the following questionnaire and submit with his offer. This data shall form a part of the contract with Successful Bidder.

(1) Wagon Tippler

a) Make and type :

b) Material of construction of main parts/units in the part list. :

c) Type of wagons that can be handled at a time. :

d) Mode of placement of wagons. :

e) Capacity of wagons that can be handled at a time. :

f) Type of speed arrestors Provided. :

g) Rail gauge :

h) Load capacity :

i) No. of tipplings/hour :

j) Average Cycle time with break up. :

k) Angle of rotation. :

l) Speed of rotation - during tippling & on return. :

m) Power consumption :

n) Drive details (KW, frame size, speed etc.) :

o) Type of motor, brake etc. :

p) Power transmission arrangement :

q) Characteristics of main units like cradle, rail table, top and side clamping device, locking gear, spill plate, liner plates (if any). :

r) Mode of control :

s) Safety features as envisaged :

t) Type of lubrication arrangement provided :

u) Gross weight and weight of the single heaviest part. :

v) Special feature (if any). :

w) Track gauge :

x) Vibrator for wagons provided? : Yes / No

y) Type of clamping & No of clamps provided. :

z) Load data for Civil/Structural/Electrical works :

(2) Dust Suppression System

Pump :

(a) Make :
(b) Type of pumps :
(c) Capacity, m^3/h :
(d) Total head, mWC :
(e) Material of Construction
  (i) Shaft :
  (ii) Impeller :
  (iii) Casing :
(f) NPSH required, m :
(g) Speed, rpm :
(h) Impeller dia, mm :
(i) Shaft power :
(j) Efficiency :
(k) Drive detail :
(l) Bearing type & make :
(m) Noise level at 1 m distance :

(n) Static weight and dynamic weight :
(p) Accessories :
(q) Weight :
(r) Performance curve :

Nozzle :

(a) Make :
(b) Dia :
(c) Water spraying cap.& Pr. required :
(d) Material of construction :
(e) Weight :

Valve :

(a) Make & type :
(b) Material of Construction :
(c) Weight :
(d) Dia :

Pipe :

(a) Make :
(b) Material :
(c) Dia :
(d) Thickness :
(e) Weight, kg/m :

(B) TECHNICAL DATA SHEET (Electrical)

MOTOR

1 Project :
2 Make :
3 Driven Equipment :
4 Motor Tag No. :
5 Quantity :
6 Voltage With Variation :
7 No. of Phases/Connection/ : No of Terminals
8 Frequency With Variation :
9 Fault Level (Mva) & Duration :
10 Motor Type And Duty :
11. KW RATING/POLE :
- At 40 Deg.C. :
- At Specified Ambient Temp.:
- With Derating.
- BHP/BKW of Driven Eqpt. : At Rated Load

12 Frame Size/Mounting :
13 Insulation Class With Temp Rise:
14 Enclosure Type :
15 Full Load Speed :
16 Full Load Torque (FLT) :
17 Starting Torque as % of FLT :
18 Pullout Torque as % of FLT :
19 FULL LOAD CURRENT (FLC) :
20 Starting Current as % of FLC :
21. Starting Time on Rated Load At :
- Rated Voltage :
- 85 % of Rated Voltage :

22. Locked Rotor Withstand Time
- Cold :
- Hot :

23 Rotation Viewed From Driving End

24 Gd Square of Motor :

25 GD Square Of Driven Equipment:

26 Weight Of Motor :

27. Power Factor at

(i) 50%Load :

(ii) 75%Load :

(iii) 100%Load :

28. Efficiency at

(iv) 50%Load :

(v) 75%Load :

(iii) 100%Load :

29 Space Heater Watts/Volts :

30 Terminal Box Type & :
No. of Terminals

31 No. of Starts Per Hour :

32 Noise Level at a Distance of 1m : From The Motor

33 Thermal Withstand Time :

34 Cooling :

35 Applicable Standard :

36 Location :

37 Hazardous Area Classification :

38. Bearing Details

(i) Type of DE/NDE :

(ii) Size of DE/NDE :

(iii) Make :

39 Location of Terminal Box :
Position From DE Side

40 Lubrication Type :

41 Cable Size :

42 Paint Shade :

43 G.A., Dimensions & Mounting : YES/NO
Detail Drawings Enclosed

44 Details Drawings FoR T.B. : YES/NO

45 Performance Characteristics : YES/NO
Curves Viz. Speed V/S Current & Speed V/S Torque Enclosed